



**A MANUAL
ON SERVICING
TRANSMISSIONS
and REAR AXLES**

●
**Covering
Passenger Cars and Trucks
1935-1942**

●
PRICE \$2.00
per copy



PERFECTION GEAR COMPANY
Harvey, Illinois

PERFECTION

Foreword

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TABLE OF CONTENTS

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	PAGES
Gearshift, Adjust (Passenger Car).....	1-17
Transmission (Passenger Car), Remove and Replace.....	18-29
Transmission (Passenger Car), Overhaul.....	30-85
Transmission (Truck), Remove, Overhaul and Replace.....	85-121
Differential Carrier, Remove, Overhaul and Replace (Passenger Car).....	122-144
Differential Carrier, Remove, Overhaul and Replace (Truck)	144-182
Axle Shaft, Remove and Replace (Passenger Car).....	183-186
Axle Shaft, Remove and Replace (Truck).....	186
INDEX	187-193

GEARSHIFT, ADJUST

Steering Column Types Only for Passenger Cars

INDEX

Car Make	Page	Car Make	Page.	Car Make	Page
BUICK	1	FORD	10	OLDSMOBILE	12
CADILLAC	2	GRAHAM	10	PACKARD	13
CHEVROLET	3	HUDSON	11	PLYMOUTH	13
CHRYSLER	8	LA SALLE	2	PONTIAC	15
DE SOTO	9	LINCOLN-ZEPHYR	11	STUDEBAKER	17
DODGE	10	MERCURY	11	WILLYS	17
		NASH	11		

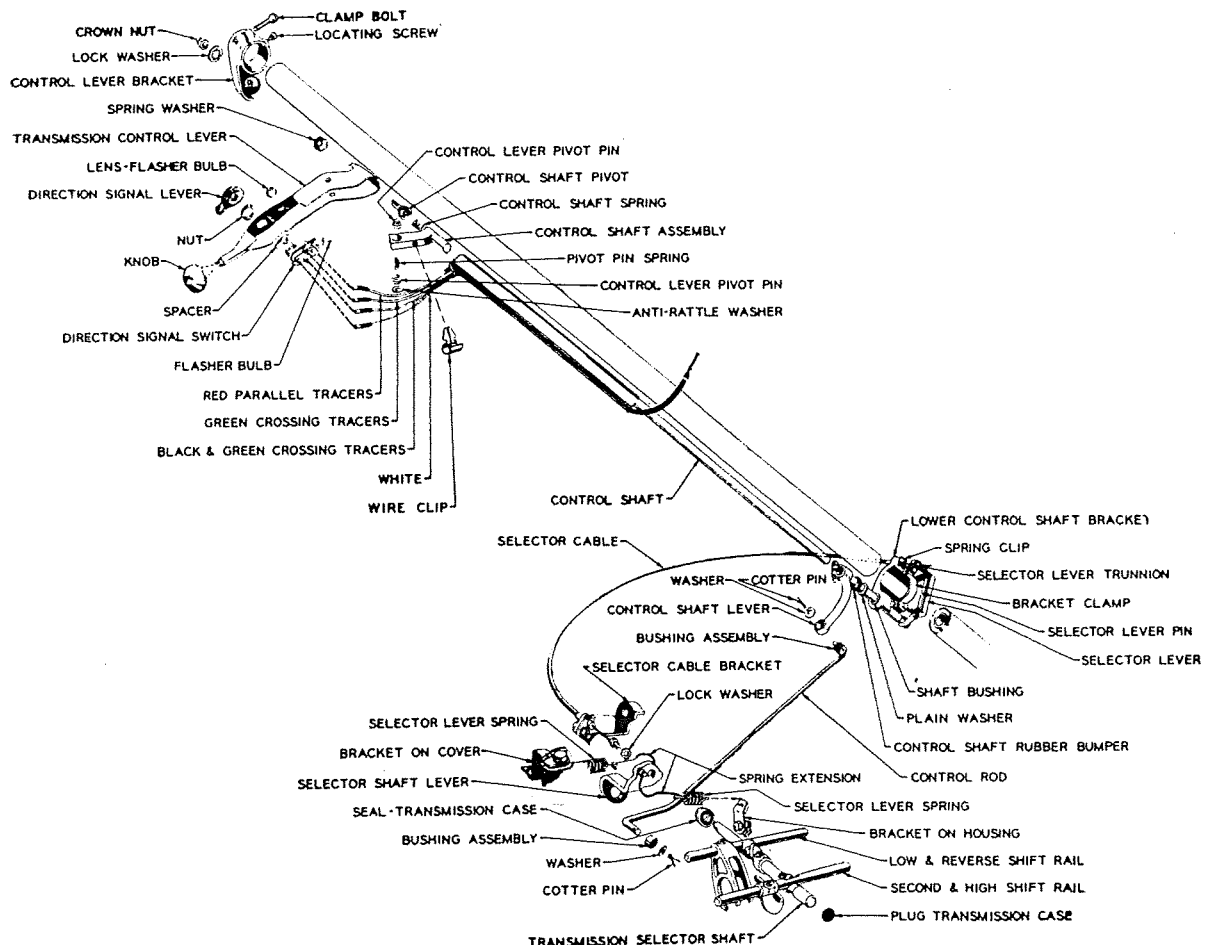


Fig. 1—Buick 1939

GEARSHIFT, ADJUST (Steering Column Types Only)

BUICK

1939: (See Fig. 1.) (1)—Shift the hand control lever into second gear. (2)—Loosen the clamp bolt

which holds the control shaft lever to the control shaft.

NOTE—The groove around the control shaft for the lever clamp bolt is wide enough to allow approximately $\frac{1}{8}$ " up and down adjustment of the lever. (3)—Use an "Allen" wrench to loosen the set screw which locks the selector cable wire in the selector lever trunnion.

GEARSHIFT, ADJUST

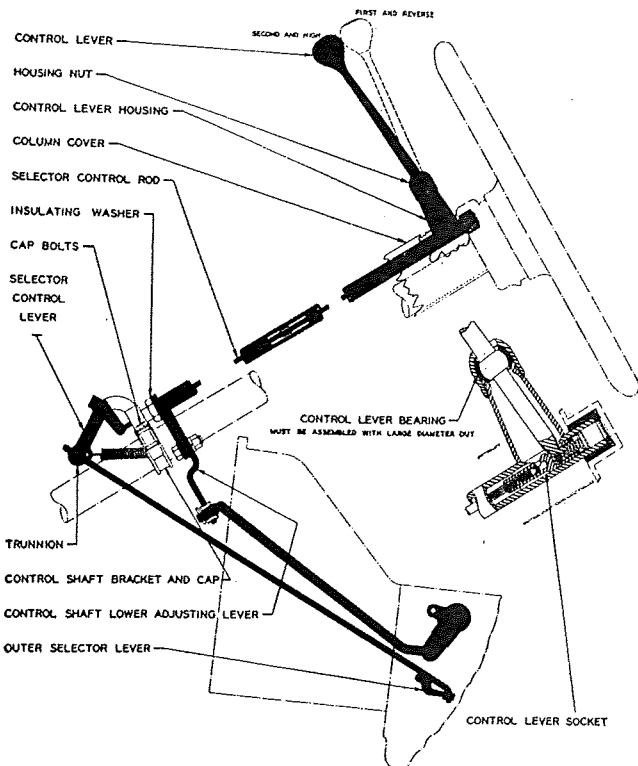


Fig. 2—Buick 1940

SHIFT CONTROL ADJUSTMENT

1—Disconnect trunnion from selector control lever shift transmission to 2nd speed and adjust trunnion until control lever has $\frac{1}{16}$ " clearance at housing nut when lever is in 2nd speed position. NOTE: This clearance is also dependent on depth when selector control rod is screwed into control lever socket. Rod should be turned to bottom in socket and backed off two turns.

2—Loosen control shaft bracket cap bolts and hold control shaft assembly up with .020" feeler gauge inserted at insulating washer. Tap control shaft bracket solidly against gauge. Tighten cap bolts when bracket is positioned. Remove feeler gauge.

TO RELOCATE LEVER POSITION TO SUIT INDIVIDUAL REQUIREMENTS

Loosen cap bolt at control shaft lower adjusting lever and move control lever housing fore or aft within limit of opening in column cover as required. Tighten bolt when housing is positioned.

shaft as far as possible into the transmission; also push inward on the selector cable wire where it extends through the trunnion, to center the wire in the cable. (8)—Lock the "Allen" set screw in the selector lever trunnion.

NOTE—These instructions afford the farthest forward location of the hand control lever. If desired to locate the lever nearer to the driver, leave more than $\frac{1}{16}$ " space when making the setting as described in item 4 above.

1940: Adjust the shift mechanism as shown in Fig. 2.

1941-42: (See Fig. 3.) Two adjustments are provided, namely; selector control lever, and the shifter rod at the idler lever. To adjust the selector control lever, place the transmission gears in neutral. Move the selector (short) rod to the rear as far as possible and adjust the trunnion to fit into the bushing in the selector lever.

To adjust the shifter (long) rod at the idler lever, place the transmission gears in second speed. Adjust the clevis at the shifter rod on the idler lever so that the control lever housing clears the opening in the mast jacket by $\frac{1}{8}$ ". NOTE—With this adjustment, an approximate $\frac{1}{8}$ " clearance between the control lever housing and the mast jacket will be obtained when the control lever is in the high gear position. Make sure that this clearance is maintained at both the upper and lower opening in the mast jacket.

CADILLAC & LA SALLE

SHIFT CONNECTING RODS, ADJUST

1938-42: (See Fig. 4.) (1)—Set the hand control lever in neutral. (2)—Lengthen or shorten the adjustable end of the low and reverse shifter rod until the control lever can be lifted into the low and reverse positions without interference. NOTE—If this adjustment is not made accurately, it will be impossible to cross over from high and second to low and reverse; and may also cause the transmission to slip out of gear. Slipping out of gear may also be caused by a binding in the rubber bushings of the shifter connecting rods or to a loose rear engine support. (3)—Finally, lengthen or shorten the adjustable end of the high and second shift connecting rod until the hand control lever can be lifted into the high and second positions without interference.

SHIFT LEVERS, ADJUST

1938-42: (See Fig. 4.) (1)—Disconnect the shift connecting rods at the levers. (2)—Remove the anti-rattle spring from the bottom of the steering column shift shaft. (3)—Apply a shift lever adjusting tool to the lower end of the second and high shift shaft at the base of the steering column and tighten the screw on the tool slightly. (4)—Loosen the clamp screw on the second and high lever. (5)—Turn the screw on the tool until two pounds tension is required to move the second and high lever back and forth (tension can be measured with a spring scale hooked to the outer end of the lever); then tighten the clamp screw.

(4)—Move the hand control lever down and forward in the second gear position until $\frac{1}{16}$ " space remains between the shift lever and the steering gear mast jacket (a $\frac{1}{16}$ " thick steel scale, or other suitable object, may be used as a spacer). (5)—Set the selector shaft lever in second gear position by pushing it in as far as possible, and shift it forward until the detents can be felt. (6)—While holding the hand control lever against the $\frac{1}{16}$ " spacer, and with the selector shaft lever still in the second gear position, lock the control shaft lever clamp bolt. (7)—Leave the control lever in second gear position and push the transmission selector

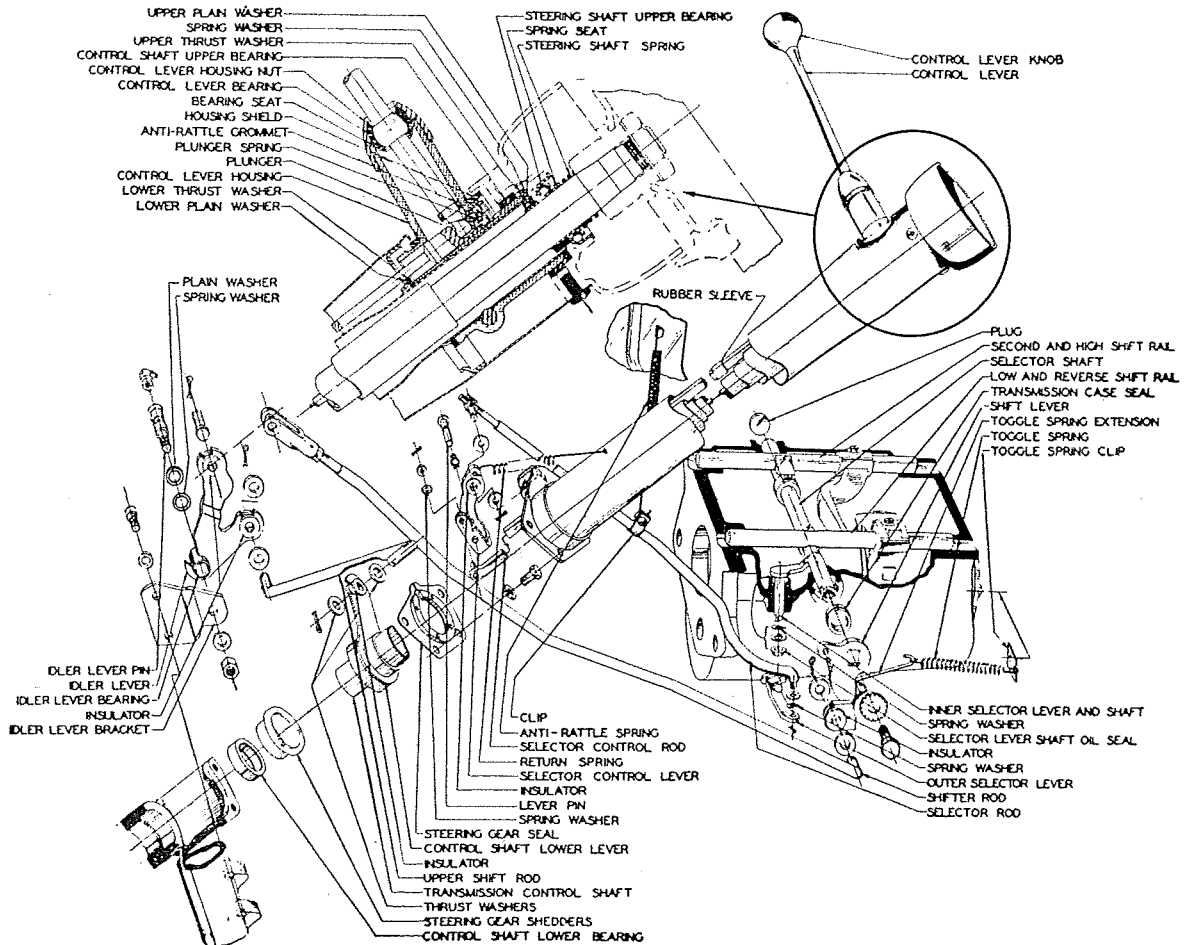


Fig. 3—Buick 1941-42

(6)—On 1938-39 cars, adjust the low and reverse lever by pushing it down until there is no more than .005" clearance between the lever and the bracket.

NOTE—On 1940-42 cars, the low and reverse lever does not require adjustment, because the adjustment between the second and high shifter shaft and the low and reverse shifter tube is definitely maintained by a collar on the lower end of the shifter shaft.

Use a large blunt screwdriver to pry the levers into position. With this method, the lever clamp screw on either lever must be tightened for each trial of the shift control.

On a few early 1938 models, the lower end of the inner torsion shaft had a 1/4-20 threaded hole instead of a groove. Therefore, to adjust the levers on these cars, use a bolt and a number of washers, turning the bolt into the threaded end of the shaft to bring the washers up against the levers, pressing them into the proper position.

CHEVROLET

VACUUM GEARSHIFT SERVICE, 1939

DISASSEMBLE: (See Fig. 5.) (1)—Remove

steering wheel. (2)—On Master DeLuxe only, take out mast jacket bearing retaining spring. (3)—Disconnect "U" clamp which attaches steering gear to instrument panel bracket. (4)—Raise toe-board grommet up on mast jacket about 12 inches. (5)—Disconnect selector rod from selector lever, and the shift control rod from shift control lever. (6)—Remove lock nut and selector control lever guide from end of selector control shaft. (7)—Unfasten lower support bracket screws and unscrew bracket from the control shaft. (8) Remove the clamp from control shaft lever and the counterbalancing spring from the lower end of control shaft, after which, the control shaft and hand control lever may be removed. (9)—(See Fig. 6.) Remove the hand control lever by pressing the pivot pins on both sides of the housing; then remove the selector push rod from the top of the control shaft.

INSPECTION: (1)—If gearshift lever housing is rough or burred, clean up with a fine mill file. (2)—Make sure that pivot pins are free in their bearings in both the control shaft housing and shift lever. (3)—See that the selector push rod rubber bushing is not tight in the tube, and if so, replace with new Neoprene bushing. (4)—Use a rat-tail file to remove any burrs which may be present at the top of the tube.

GEARSHIFT, ADJUST

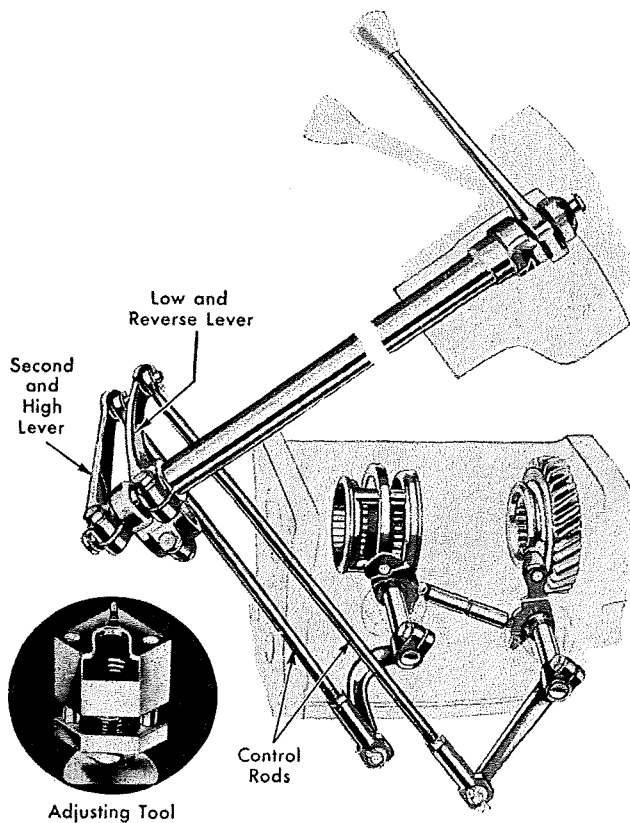


Fig. 4—Cadillac-La Salle 1938-42

ASSEMBLE: (1)—Install selector push rod in control shaft. (2)—Replace pivot pins and spring in shift lever, assembling the anti-rattle washer on one pin and a shim on the other. (3)—Compress the springs and slip the assembly into the gearshift lever housing, while at the same time, the open end of the shift lever must be slipped over the end of the selector push rod. (4)—Check for free operation of shift lever and selector push rod. (5)—The location of the upper support bracket with reference to the top of the mast jacket should be $\frac{3}{8}$ " on Master DeLuxe cars and $1\frac{3}{16}$ " on Master models. Before tightening the bracket screw, make sure the keyway in the bracket matches with the key which projects on the mast jacket. (6)—Thread the control shaft through the instrument panel bracket and through the toe-board grommet. (7)—Replace the counterbalancing spring and the shift control lever on the lower end of the control shaft, slipping it up on the "D" section as far as possible. (8)—Screw the lower support bracket on the control shaft until the shaft extends beyond the bracket $\frac{3}{16}$ " as shown in Fig. 7. (9)—Place the end of the control shaft in the upper support bracket, allowing the end of the counterbalancing spring to drop in behind the mast jacket. (10)—Install the lower support bracket on the mast jacket, being sure to match the keyway with the key on the mast jacket. (11)—Install the bracket cap and tighten the screws just snug.

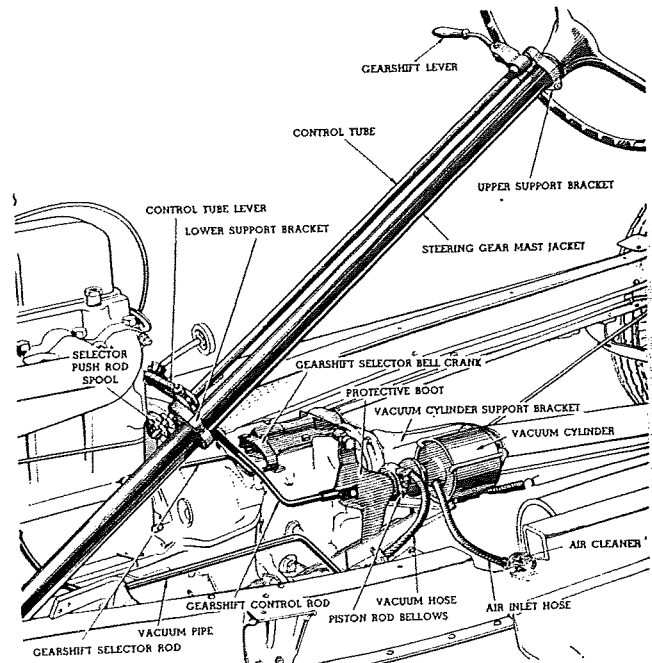


Fig. 5—Chevrolet 1939

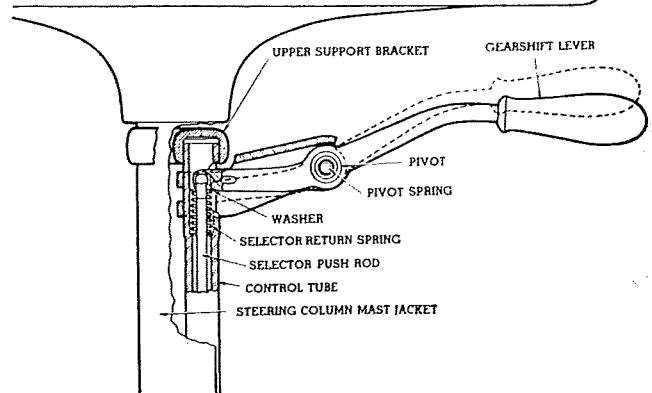


Fig. 6—Chevrolet 1939. Gearshift Lever Cross Section

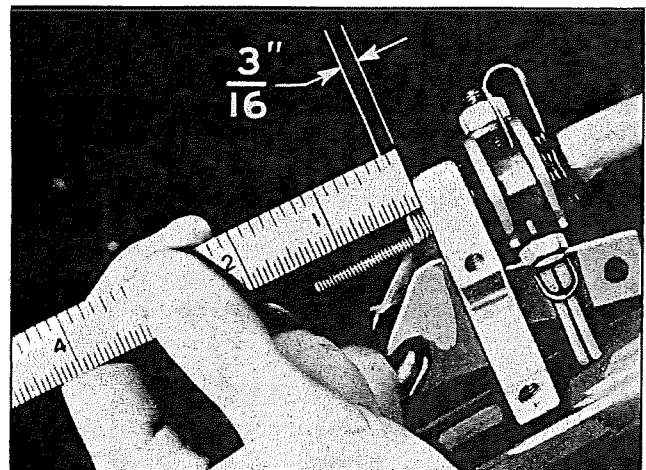


Fig. 7—Chevrolet 1939. Assembling Lower Bracket

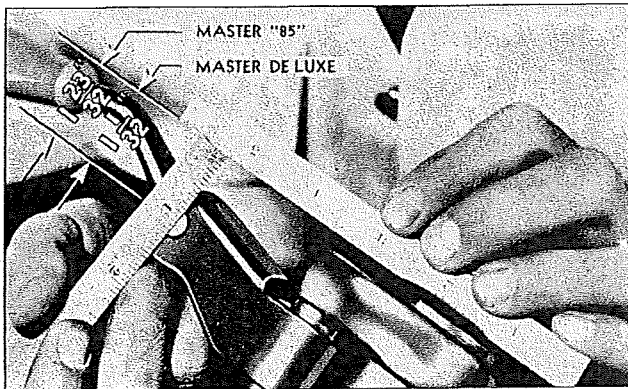


Fig. 8—Chevrolet 1939. Gearshift Lever Adjustment

ADJUSTMENTS, 1939

GEARSHIFT LEVER: The relationship of the gear shift lever to the top of the mast jacket should be as shown in Fig. 8. To obtain this measurement, shift the lower support bracket up or down on the mast jacket, then tighten the bracket screws.

CONTROL SHAFT LEVER: Adjust the control lever up or down on the control shaft to secure $\frac{3}{16}$ " clearance as shown in Fig. 9. Then tighten the shift control lever clamp bolt, and hook the counterbalancing spring in place under the lever.

SELECTOR LEVER GUIDE: With the end of the selector lever bell crank in the groove of the selector lever guide, screw the guide on the selector control rod until there is $\frac{1}{16}$ " clearance as shown in Fig. 10. Then install the guide lock nut securely.

MAST JACKET POSITION: If the distance between the horn contact ring at the top of the mast

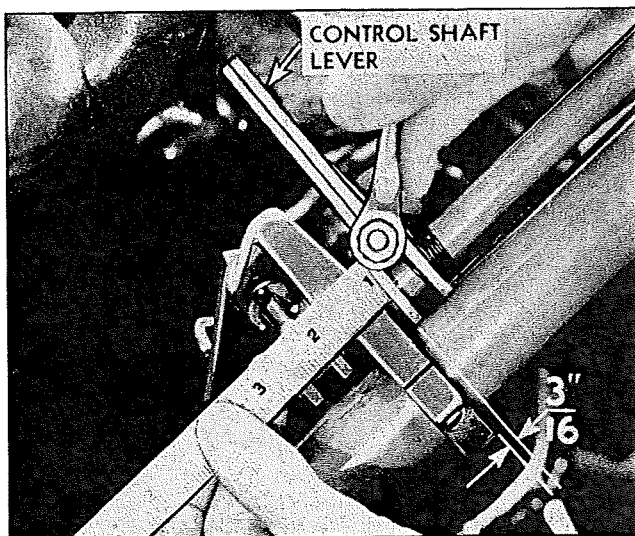


Fig. 9—Chevrolet 1939. Control Shaft Lever Adjustment

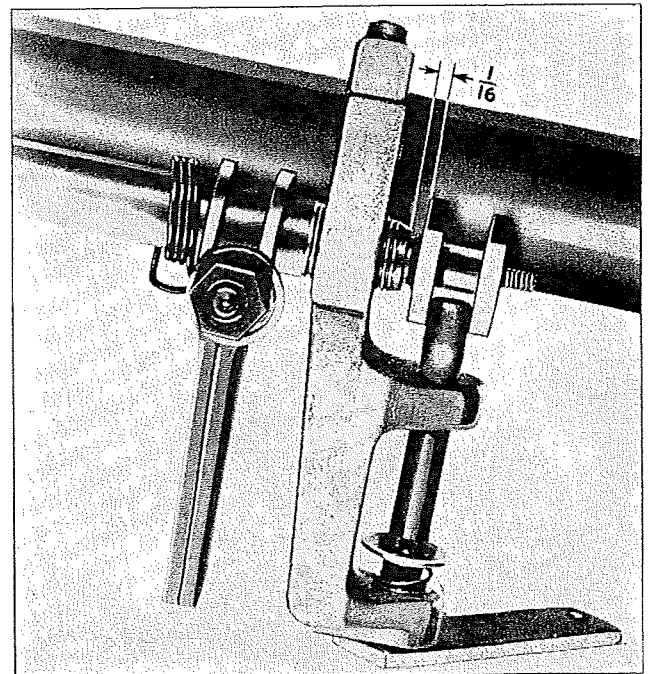


Fig. 10—Chevrolet 1939. Selector Lever Guide Adjustment

jacket and the shoulder at the top of the steering column is not as shown in Fig. 11, loosen the mast jacket clamp bolt and move the jacket up or down. Install the steering wheel.

SHIFT SELECTOR ROD: (1)—Pull the selector control rod forward to bottom of transmission, interlock firmly against its stop. (2)—In this position, ad-

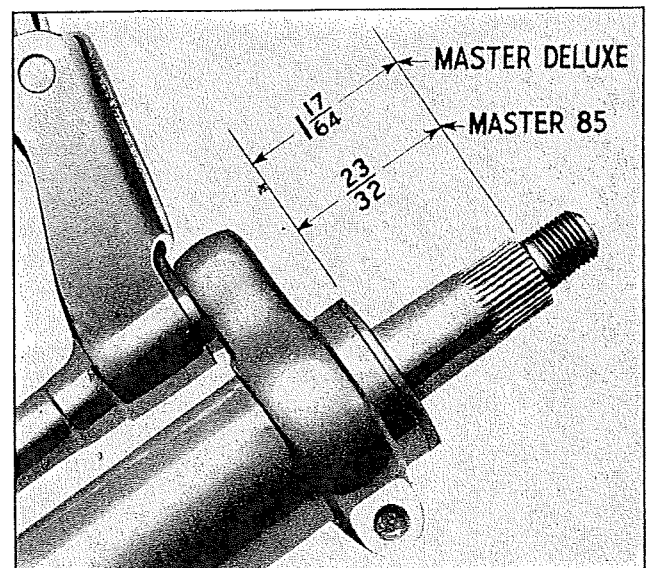


Fig. 11—Chevrolet 1939. Mast Jacket Position

GEARSHIFT, ADJUST

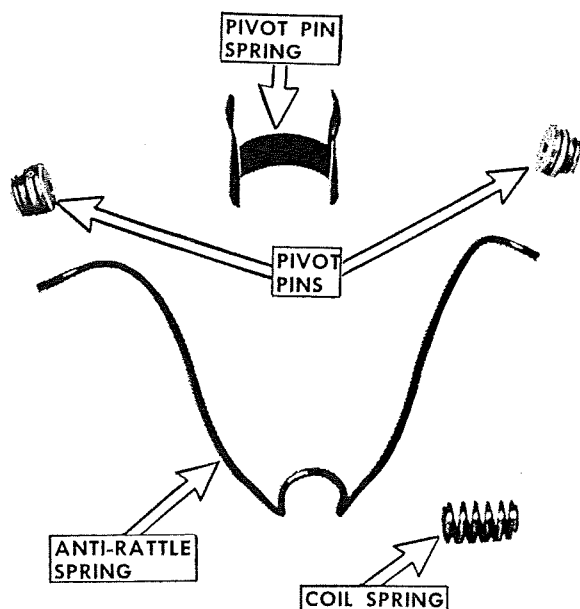


Fig. 12—Chevrolet 1940-42. Gearshift Lever Parts

just the swivel by screwing it up or down on the rod. (3)—When the swivel is $\frac{1}{8}$ " to the rear of the hole in the lever, tighten the swivel lock nut. (4)—Pull the lever rearward and connect the rod; install the anti-rattle spring, washer and cotter pin onto the swivel pivot pin.

SHIFT CONTROL ROD: (1)—With the gearshift lever in a horizontal position, locate the clevis pin in the end of the shift control rod so that it is in the center of the elongated hole in the transmission operating lever. (2)—Adjust the swivel up or down on the control rod until its pivot lines up with the hole in the shift control lever, and install the anti-rattle spring and lock.

VACUUM GEARSHIFT SERVICE, 1940-42

REMOVE: (1)—Remove steering wheel. (2)—Disconnect clamp which attaches mast jacket to instrument panel. (3)—Detach control rod from operating lever, and selector rod from selector lever. (4)—Remove clamp bolt and take off gearshift control lever and spring. (5)—Detach gearshift control upper support bracket from the mast jacket, after which, the gearshift lever and control rod assembly may be removed.

DISASSEMBLE: (1)—Mount assembly in a vise. (2)—Depress shift lever pivot pins and lift up on end of lever, pulling outward at the same time to remove the lever. (3)—Remove coil spring from the end of control shaft lever. (4)—Compress legs of anti-rattle spring, and remove spring, pivot pin spring and pivot pins. (5)—Slide upper control shaft out of upper support and unscrew gearshift lever swivel from upper support.

ASSEMBLE: (See Fig. 14.) (1)—Coat gearshift lever lightly with graphite grease and screw it into

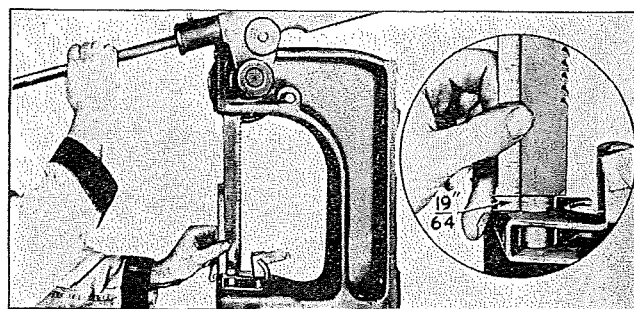


Fig. 13—Chevrolet 1940-42
Lower Support Bushing Position

upper support until the shoulder of the upper support extends above the support about $\frac{1}{8}$ ". (2)—Thread the control shaft through the upper support and swivel. (3)—Install the pivot pin spring, and assemble the pivot pins into the holes in the gearshift lever swivel. (4)—Thread the anti-rattle spring into the holes in the pivot pins. (5)—Snap the end of the anti-rattle spring over the control shaft lever. (6)—Install the gearshift lever anti-rattle coil spring. (7)—Coat the ball and spring on the end of the control shaft lever lightly with graphite grease. (8)—Thread the gearshift lever over the control shaft lever and anti-rattle spring. (9)—Compress pivot pins, and at the same time, press down on top of the lever until the pivot pins snap into place. (10)—(See Fig. 13.) If a new bushing is to be installed in the lower support, press it in place until the distance from the end of the bushing to the face of the lower support is $\frac{19}{64}$ ". (11)—Install lower support assembly to mast jacket, being sure to engage the key; then tighten the clamp bolts JUST SNUG. (12)—(See Fig. 14.) Screw the upper support up or down on swivel until the distance between lower edge of gearshift lever and top of support is from $\frac{3}{32}$ " to $\frac{1}{8}$ ". (13)—Thread the toe-board grommet over the control shaft and through the rubber bushing in the lower support. (14)—Attach upper support to mast jacket. (15)—Replace clamp bolt which fastens instrument panel to mast jacket. (16)—Assemble spring and

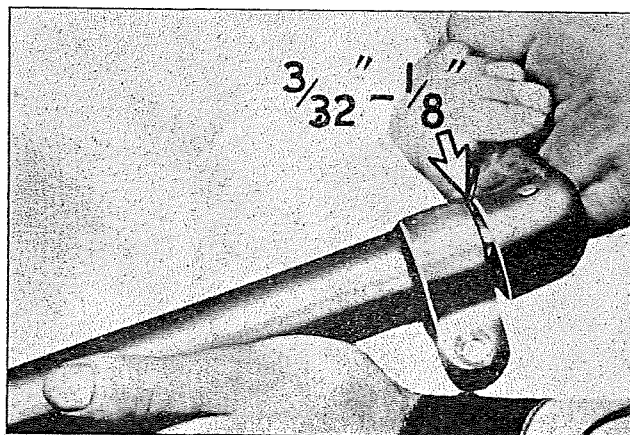


Fig. 14—Chevrolet 1940-42. Upper Support Position

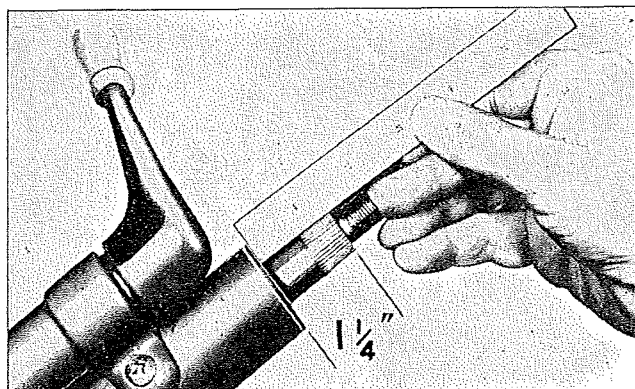


Fig. 15—Chevrolet 1940-42. Mast Jacket Position

shift lever on control shaft, being sure to pick up the selector operating lever; then install the clamp bolt and tighten securely.

ADJUSTMENTS, 1940-42

MAST JACKET POSITION: If the distance between the horn contact ring at the top of the mast jacket and the shoulder at the top of the steering column is not as shown in Fig. 15, move the mast jacket up or down as required. Permissible limits are plus $\frac{3}{32}$ " and minus zero. Install steering wheel.

SELECTOR ROD: (See Fig. 16.) (1)—Loosen check nut on selector rod adjustment. (2)—Pull selector rod forward as far as possible. (3)—Screw the swivel up or down on the rod until the underside of the steering wheel and the top of the shift lever is $1\frac{27}{32}$ ", when the selector rod is connected.

SHIFT CONTROL ROD: (See Fig. 17.) (1)—Set gearshift lever in a horizontal position. (2)—Loosen check nut and push control rod back until all clearance is taken up. (3)—Note location of swivel with reference to the shift control lever. (4)—Pull control rod forward until all clearance is removed, and again note location of swivel. (5)—The neutral valve position is a point midway between these two noted positions. (6)—Screw the swivel up or down until the pivot just enters the shift control lever.

LOWER SUPPORT BRACKET: (See Fig. 18.) Move the lower support bracket up or down on the mast jacket until the distance between the underside of the bracket and the upper side of the shift control lever is $\frac{3}{4}$ ". NOTE—When tightening the clamp bolts, use care to avoid crushing the mast jacket.

VACUUM CYLINDER VALVE, ADJUST

1939-42: (1)—Disconnect piston rod yoke and valve links from reactionary levers. (2)—Push piston into the cylinder to provide clearance for making adjustments. (3)—For 1939 cars, a special bushing should be made to the dimensions as shown in Fig. 19. For 1940-42 models, a special bushing is required and

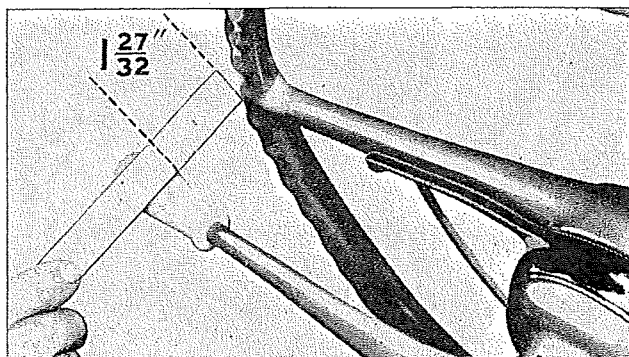


Fig. 16—Chevrolet 1940-42
Checking Selector Rod Swivel Adjustment

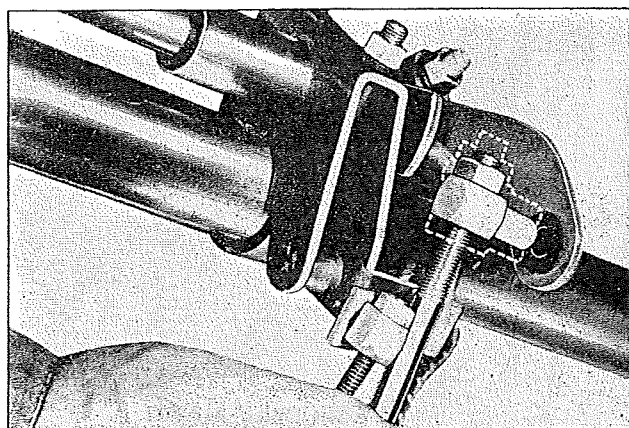


Fig. 17—Chevrolet 1940-42
Shift Control Rod Adjustment

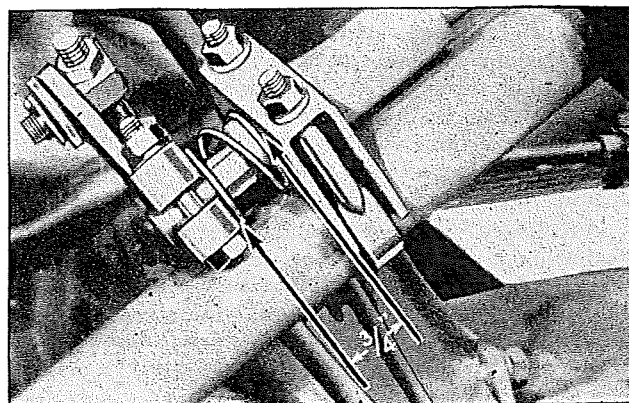


Fig. 18—Chevrolet 1940-42
Lower Support Bracket Position

should be made to the following dimensions: Length, $\frac{11}{16}$ ", plus or minus .005"; outside diameter, .938" to .9415"; diameter of hole, .314" to .316". (4)—Thread this special bushing through the eyes of the valve links; then raise the bushing with the links inside the piston

GEARSHIFT, ADJUST

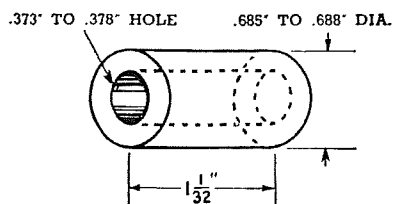


Fig. 19—Chevrolet 1939

Dimensions for Vacuum Cylinder Adjusting Bushing.
See Text for Bushing Dimensions on 1940-42 Cars

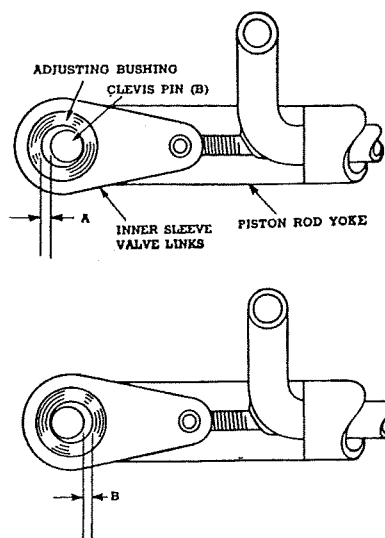


Fig. 20—Chevrolet 1939-42

Method of Checking Vacuum Cylinder Adjustment

rod yoke, and replace the clevis pin through the yoke and bushing. (5)—(See Fig. 20.) With the engine running to provide a source of vacuum, move the valve links away from the cylinder until all clearance between the adjusting bushing and the clevis pin is toward the front as indicated at "A"; in this position, the piston rod should move slowly outward. Now move the valve links toward the cylinder until all the clearance is toward the rear as shown at "B"; in this position, the piston rod should move slowly inward.

NOTE—If the piston will move outward only, the valve links are adjusted too far toward the cylinder. If this condition exists, UNSCREW the links in the valve rod $\frac{1}{2}$ turn at a time until the correct valve action is obtained. Similarly, if the piston moves inward only, SCREW the links on the valve rod $\frac{1}{2}$ turn at a time until the valve action is correct.

CHRYSLER

SHIFT CONTROL ROD, ADJUST

1939: (See Fig. 21.) (1)—Disconnect the control rod from the shift lever at the transmission. (2)—Set the hand control lever and the transmission gears in neutral. (3)—Adjust the length of the rod by turning its threaded end up or down into the adjustable joint

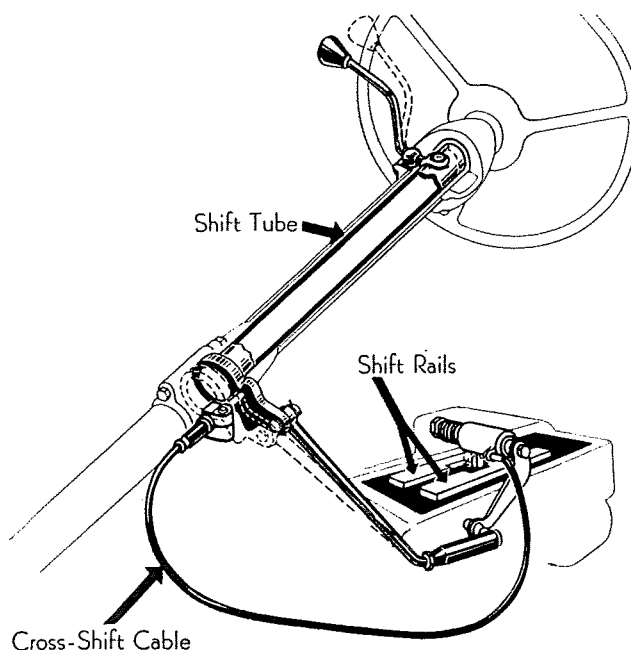


Fig. 21—Chrysler, De Soto, Dodge and Plymouth 1939

until the rod slips freely into the lever, when the lever is held toward the rear of the transmission. (4)—Tighten the lock nut.

1940: (1)—Loosen the lock bolt which fastens the lever on the lower end of the steering column. (2)—Set the transmission gears in neutral and position the hand control lever 10 degrees above the horizontal, and tighten the lock bolt.

1941-42 MANUAL SHIFT: (See Fig. 22.) (1)—Loosen the lock bolt at the upper lever on the lower end of the steering column. (2)—Set the transmission gears in neutral and position the hand control lever in a horizontal position, and tighten the lock bolt.

SHIFT SELECTOR, ADJUST

1939: (See Fig. 21.) (1)—Loosen the clamp screw at the steering column end of the cable. (2)—Set the hand control lever in neutral and loosen the ferrule screw—which is just below the clamp screw—until end play develops between the plunger end of the cable and the clover-leaf plate. (3)—Then tighten the screw just enough to eliminate end play. NOTE—Do not tighten too much, otherwise excessive wear will develop at the end of the cable and the plate. (4)—When adjusted properly, tighten the clamp screw.

1940: (1)—With the transmission gears in neutral, loosen the lock nut at the transmission end of the cable. (2)—Tighten the acorn nut until all play is removed from the cable, then back off the nut $\frac{1}{2}$ turn for clearance. (3)—Tighten the lock nut.

1941-42 MANUAL SHIFT: (1)—Set the transmission gear in neutral and loosen the lock nut on the selector rod at the transmission end. (2)—Tighten the

nut until all play is removed and back off $\frac{1}{2}$ turn for clearance. (3)—Tighten the lock nut.

POWER SHIFT ADJUSTMENTS

1941 VALVE ACTION, ADJUST: (See Fig. 23.) (1)—To adjust the vacuum cylinder valve, remove the boot and valve clevis pin. (2)—If the shift is sluggish into second or reverse, screw the clevis OUT on the valve rod. (3)—If sluggish into first or third, screw the clevis IN on the valve rod. NOTE—When making adjustments, screw the clevis $\frac{1}{2}$ turn at a time in the desired direction until proper valve action is obtained. This precaution is necessary to avoid the possibility of creating a sluggish valve action in the opposite speeds when trying to eliminate the condition in those speeds being adjusted.

1941 NEUTRAL POSITION, ADJUST: (1)—Remove selector rod. (2)—Slacken the detent spring screw in the reaction levers. (3)—With engine running to provide a source of vacuum, and with wheels off the ground, move the power lever and links back and forth a very small amount. At the same time, move the selector arm until a clean and positive cross-over is felt in this position. (4)—Then move the detent spring so that the boss indexes with the notch in the lever, and tighten the bracket clamp bolt. (5)—Connect and adjust the selector rod as already described for the MANUAL SHIFT.

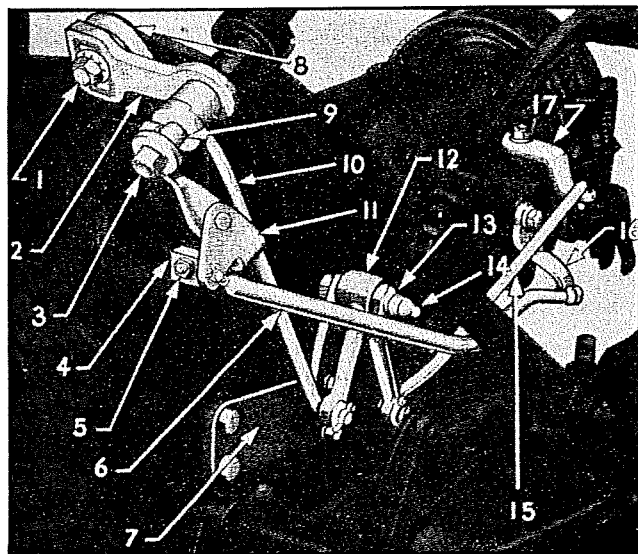


Fig. 22—Gearshift Control Rods
Chrysler, De Soto, Dodge and Plymouth 1941-42

- | | |
|------------------------------|---------------------------------|
| 1—Control rod lever stud nut | 10—Front control rod |
| 2—Control rod lever | 11—Column jacket selector lever |
| 3—Control rod end nut | 12—Bellcrank and bushing |
| 4—Selector rod swivel | 13—Bellcrank bolt |
| 5—Selector rod adjusting nut | 14—Lubricant nipple |
| 6—Selector rod | 15—Rear control rod |
| 7—Bellcrank bracket | 16—Transmission selector lever |
| 8—Front control rod bushing | 17—Transmission operating lever |
| 9—Control rod end | |

DE SOTO

SHIFT CONTROL ROD, ADJUST

1939: (See Fig. 21.) (1)—Disconnect the control rod from the shift lever at the transmission. (2)—Set the hand control lever and the transmission gears in neutral. (3)—Adjust the length of the rod by turn-

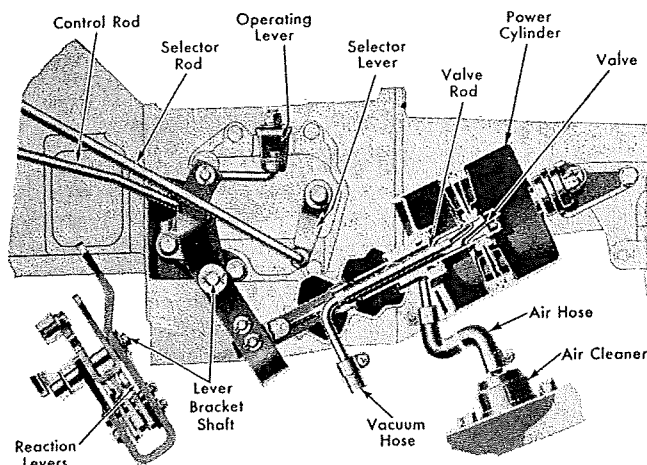


Fig. 23—Power Shift.
Chrysler, De Soto, Dodge and Plymouth 1941

ing its threaded end up or down into the adjustable joint until the rod slips freely into the lever, when the lever is held toward the rear of the transmission. (4)—Tighten the lock nut.

1940: (1)—Loosen the lock bolt which fastens the lever on the lower end of the steering column. (2)—Set the transmission gears in neutral and position the hand control lever 10 degrees above the horizontal, and tighten the lock bolt.

1941-42 MANUAL SHIFT: (See Fig. 22.) (1)—Loosen the lock bolt at the upper lever on the lower end of the steering column. (2)—Set the transmission gears in neutral and position the hand control lever in a horizontal position, and tighten the lock bolt.

SHIFT SELECTOR, ADJUST

1939: (See Fig. 21.) (1)—Loosen the clamp screw at the transmission end of the cable. (2)—Set the hand control lever in neutral and loosen the ferrule screw—which is just below the clamp screw—until end play develops between the plunger end of the cable and the clover-leaf plate. (3)—Then tighten the screw just enough to eliminate end play. NOTE—Do not tighten too much, otherwise excessive wear will develop at the

GEARSHIFT, ADJUST

end of the cable and the plate. (4)—When adjusted properly, tighten the clamp screw.

1940: (1)—With the transmission gears in neutral, loosen the lock nut at the transmission end of the cable. (2)—Tighten the acorn nut until all play is removed from the cable, then back off the nut $\frac{1}{2}$ turn for clearance. (3)—Tighten the lock nut.

1941-42 MANUAL SHIFT: (1)—Set the transmission gears in neutral and loosen the lock nut on the selector rod at the transmission end. (2)—Tighten the nut until all play is removed and back off $\frac{1}{2}$ turn for clearance. (3)—Tighten the lock nut.

POWER SHIFT ADJUSTMENTS

1941 VALVE ACTION, ADJUST: (See Fig. 23.) (1)—To adjust the vacuum cylinder valve, remove the boot end valve clevis pin. (2)—If the shift is sluggish into second or reverse, screw the clevis OUT on the valve rod. (3)—If sluggish into first or third, screw the clevis IN on the valve rod. NOTE—When making adjustments, screw the clevis $\frac{1}{2}$ turn at a time in the desired direction until proper valve action is obtained. This precaution is necessary to avoid the possibility of creating a sluggish valve action in the opposite speeds when trying to eliminate the condition in those speeds being adjusted.

1941 NEUTRAL POSITION, ADJUST: (1)—Remove selector rod. (2)—Slacken the detent spring screw in the reaction levers. (3)—With engine running to provide a source of vacuum, and with wheels off the ground, move the power lever and links back and forth a very small amount. At the same time, move the selector arm until a clean and positive crossover is felt in this position. (4)—Then move the detent spring until the boss indexes the notch in the lever, and tighten the bracket clamp bolt. (5)—Connect and adjust the selector rod as already described for MANUAL SHIFT.

DODGE

SHIFT CONTROL ROD, ADJUST

1939: (See Fig. 21.) (1)—Disconnect the control rod from the shift lever at the transmission. (2)—Set the hand control lever and the transmission gears in neutral. (3)—Adjust the length of the rod by turning its threaded end up or down into the adjustable joint until the rod slips freely into the lever, when the lever is held toward the rear of the transmission. (4)—Tighten the lock nut.

1940: (1)—Loosen the lock bolt which fastens the lever on the lower end of the steering column. (2)—Set the transmission gears in neutral and position the hand control lever 10 degrees above the horizontal, and tighten the lock bolt.

1941-42 MANUAL SHIFT: (See Fig. 22.) (1)—Loosen the lock bolt at the upper lever on the lower

end of the steering column. (2)—Set the transmission gears in neutral and position the hand control lever in a horizontal position, and tighten the lock bolt.

SHIFT SELECTOR, ADJUST

1939: (See Fig. 21.) (1)—Loosen the clamp screw at the transmission end of the cable. (2)—Set the hand control lever in neutral and loosen the ferrule screw—which is just below the clamp screw—until end play develops between the plunger end of the cable and the clover-leaf plate. (3)—Then tighten the screw just enough to eliminate end play. NOTE—Do not tighten too much, otherwise excessive wear will develop at the end of the cable and the plate. (4)—When adjusted properly, tighten the clamp screw.

1940: (1)—With the transmission gears in neutral, loosen the lock nut at the transmission end of the cable. (2)—Tighten the acorn nut until all play is removed from the cable, then back off the nut $\frac{1}{2}$ turn for clearance. (3)—Tighten the lock nut.

1941-42 MANUAL SHIFT: (1)—Set the transmission gears in neutral and loosen the lock nut on the selector rod at the transmission end. (2)—Tighten the nut until all play is removed and back off $\frac{1}{2}$ turn for clearance. (3)—Tighten the lock nut.

POWER SHIFT ADJUSTMENTS

1941-42 VALVE ACTION, ADJUST: (See Fig. 23.) (1)—To adjust the vacuum cylinder valve, remove the boot and valve clevis pin. (2)—If the shift is sluggish into second or reverse, screw the clevis OUT on the valve rod. (3)—If sluggish into first or third, screw the clevis IN on the valve rod. NOTE—When making adjustments, screw the clevis $\frac{1}{2}$ turn at a time in the desired direction until proper valve action is obtained. This precaution is necessary to avoid the possibility of creating a sluggish valve action in the opposite speeds when trying to eliminate the condition in those speeds being adjusted.

1941-42 NEUTRAL POSITION, ADJUST: (1)—Remove selector rod. (2)—Slacken the detent spring screw in the reaction levers. (3)—With engine running to provide a source of vacuum, and with wheels off the ground, move the power lever and links back and forth a very small amount. At the same time, move the selector arm until a clean and positive crossover is felt in this position. (4)—Then move the detent spring until the boss indexes the notch in the lever, and tighten the bracket clamp bolt. (5)—Connect and adjust the selector rod as already described for MANUAL SHIFT.

FORD

1940-42: Adjust the shift mechanism as shown in Fig. 24.

GRAHAM

1940: (See Fig. 25.) (1)—To adjust the control

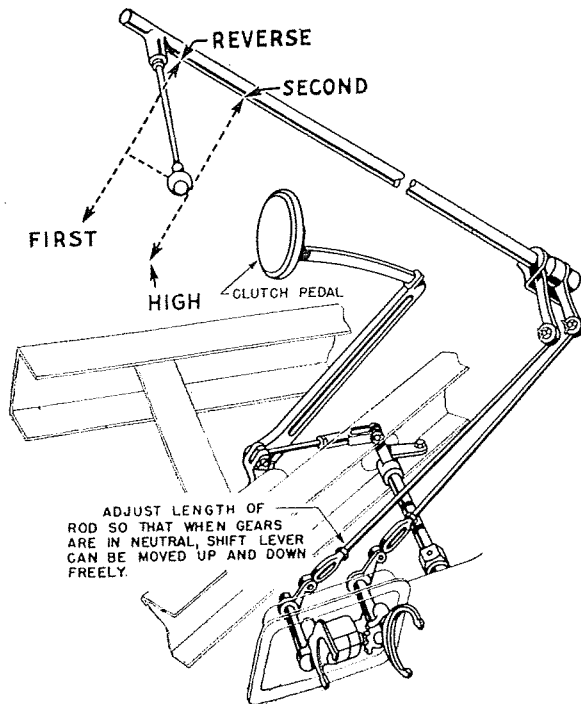


Fig. 24—Ford, Lincoln and Mercury 1940-42

lever, shift the transmission into neutral. (2)—Loosen the lock nut on the selector rod and adjust the clevis so that the pin will slide in freely when the lever on the transmission case is raised up to its limit. (3)—Next loosen both lock nuts on the shifting rod at the block on its transmission end. (4)—Place the control lever on the steering gear as far forward as it will go in the second speed position. (5)—Move the lever on the transmission case forward to the limit of its travel, then turn down the top nut on the shifting rod until the nut is exactly $\frac{3}{16}$ " from the square block. (5)—Then tighten the lower nut securely.

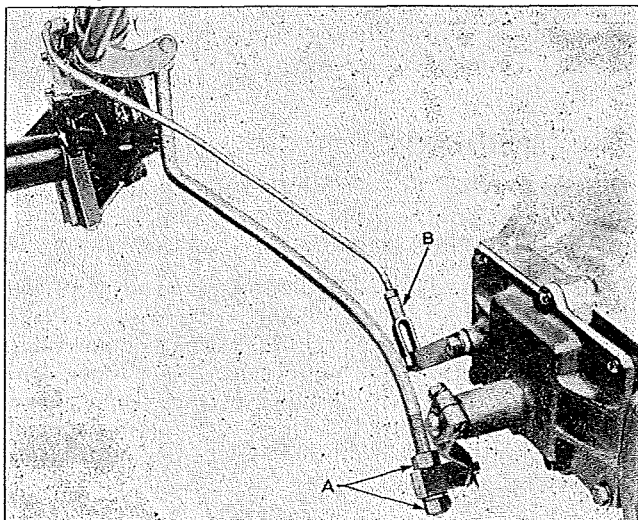


Fig. 25—Graham 1940

A—Shift rod adjusting nuts. B—Selector rod clevis.

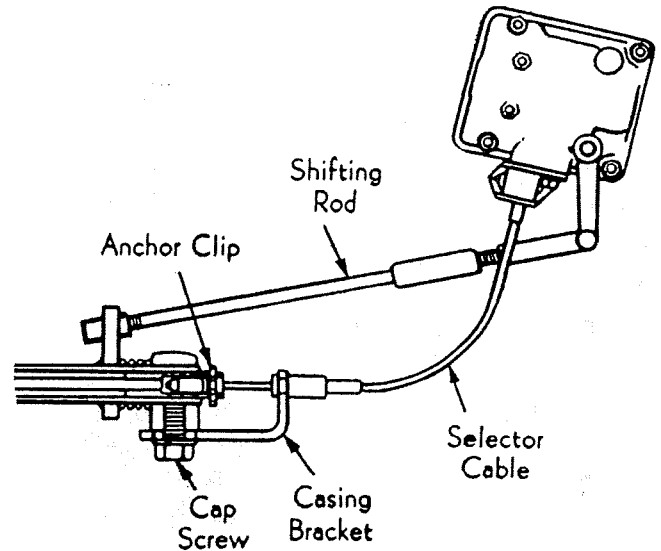


Fig. 26—Hudson 1939-42

HUDSON

OPERATING ROD, ADJUST

1939-42: (See Fig. 26.) (1)—Raise the front end of the car and work from underneath. (2)—Remove the clevis pin and cotter pin in the yoke end of the operating rod at the transmission end. (3)—With the transmission cover lever and hand control lever in neutral, loosen the yoke lock nut and turn the yoke until the clevis pin will drop into the lever without moving either levers.

CROSS SHIFT, ADJUST

1939-42: This adjustment can be made from the top after raising the hood. (1)—Loosen the control wire anchor bracket bolt at the lower end of the steering column. (2)—Pull the casing bracket up until all slack is removed from the casing, and the shift shaft in the transmission is fully over to the low and reverse side. (3)—Tighten the anchor bracket bolt in place. NOTE—Be sure that there is some clearance at the top and bottom of the travel of the anchor clip.

LINCOLN ZEPHYR

1940-42: Adjust the shift mechanism as shown in Fig. 24.

MERCURY

1940-42: Adjust the shift mechanism as shown in Fig. 24.

NASH

1940: (See Fig. 27.) (1)—To adjust the control rods, it is necessary to use a special aligning pin. (2)—

GEARSHIFT, ADJUST

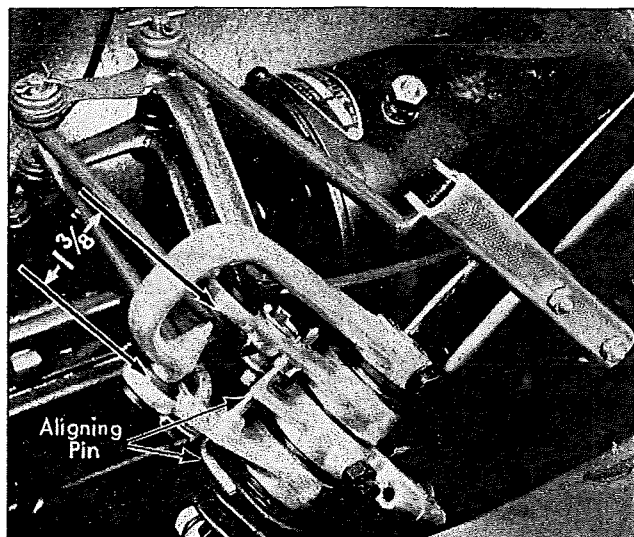


Fig. 27—Nash 1940
Showing aligning pin in position

Install the aligning pin through the second and high and the low and reverse levers, and also through the notch in the bearing tube bracket at the bottom of the steering column. (3)—Loosen the bearing tube bracket lock nut and screw. (4)—The lower shift lever which is clamped and keyed to the main control rod should be moved up or down to be sure that its tapered points enter the rubber grommets in the second and high and low and reverse levers cleanly. (5)—When the correct position is obtained, tighten the bearing tube bracket lock nut and screw. (6)—With the control lever in neutral and the aligning pin in place, loosen the set screws in the swivel blocks at the transmission end of the control rods. (7)—Make sure that the trans-

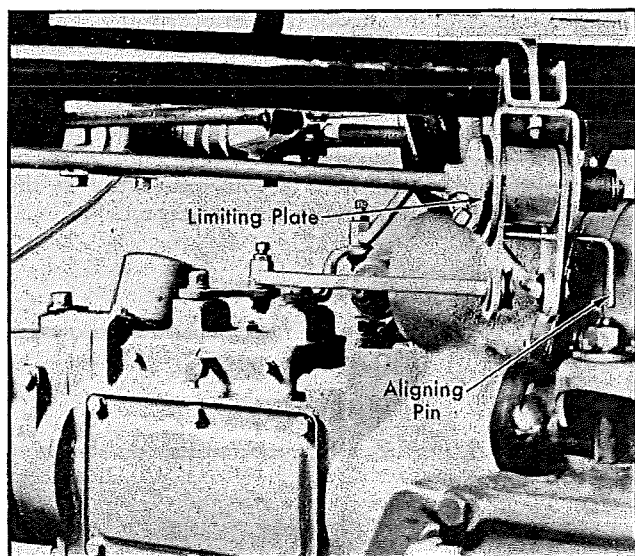


Fig. 28—Nash 1941-42

mission levers are in neutral and then tighten the swivel block lock screws without moving the levers or rods out of their neutral positions.

1941-42: (See Fig. 28.) The control rods are adjusted by installing the special aligning pin through the holes in both levers in the same manner as described for 1940 cars. Loosen the set screws at the transmission end of the shift control rods. Set the levers at the transmission in their exact neutral position and tighten the set screws.

The limiting plate should be adjusted with relation to the main control shaft so that the selector key will not rub on the lower inside surface of the shift bracket. To make this adjustment, engage the selector key with the second and high shift lever, then raise the main control shaft slightly to provide clearance. Lock the limiting plate with the set screw and lock nut.

OLDSMOBILE

SHIFT SELECTOR, ADJUST

1939: (See Fig. 29.) The selector cable adjusting nuts (at the cable anchor bracket, steering column end) determines the vertical distance between the hand control lever and the steering wheel. With the transmission in neutral, this dimension should be from $2\frac{7}{16}$ " to $2\frac{9}{16}$ ", and is obtained by turning the two adjusting nuts to lengthen or shorten the control shaft and cable.

1940-42: Before making the adjustment, the selector rod must be assembled in place between the lower control lever and the transmission, and with the gears in neutral.

To make the adjustment, remove the clevis pin from the lever at the lower end of the control shaft at the steering column. Turn the selector rod adjusting screw until the vertical distance between the hand control lever and the rim of the steering wheel is from $2\frac{11}{16}$ " to $2\frac{13}{16}$ ". Turning the screw up reduces the clearance.

SHIFT CONTROL ROD, ADJUST

1939-42: (See Fig. 30.) With the transmission in neutral, the hand control lever should be approximately $1\frac{1}{2}$ " above the horizontal position.

For 1939 cars, disconnect the lower control rod from the selector shaft lever at the transmission. Place special gauge in position on the steering column cable anchor bracket, with the upper end of the lower control rod in the slotted opening in the gauge. Then adjust the clevis on the lower end of the lower control rod (at transmission) until the pin enters the clevis and selector shaft freely.

NOTE—For 1940-42 models, the adjustment is made in the same manner except that special gauges are required for each year.

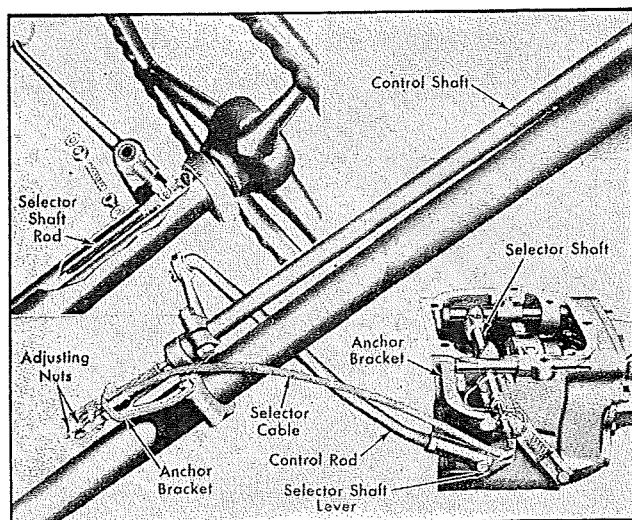


Fig. 29—Oldsmobile 1939

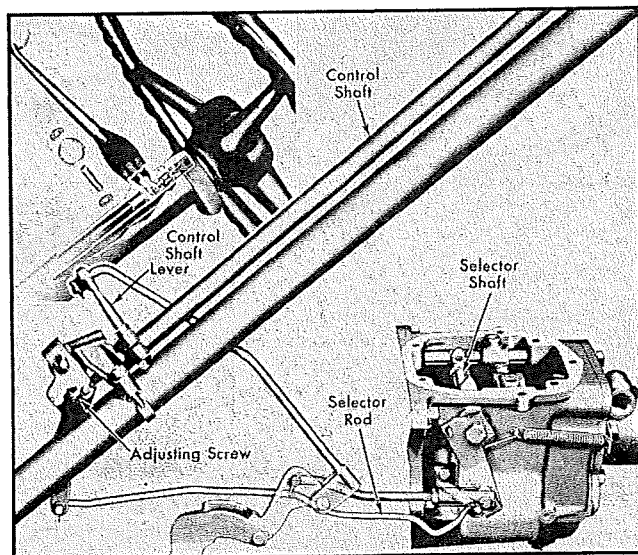


Fig. 30—Oldsmobile 1941-42. 1940 is Similar

PACKARD

1939-40: (See Fig. 31.) (1)—To adjust the linkage, insert a $\frac{3}{16}$ " aligning pin or drill rod through the aligning holes of both the column shaft levers. (2)—Set the hand control lever and the levers on the transmission in neutral and disconnect the upper and lower control rods. (3)—Adjust the length of the rods until they slip into place in their levers at the transmission without moving any of the levers from the neutral position.

1941-42: The adjustments are the same as described for 1940 cars except that a rubber button is used at the lower end of the steering column jacket to act as a stop for the high gear shift.

To make the adjustment for the high gear stop, place the hand control lever in high gear position and loosen the lock nut which holds the rubber button in place. Then turn the adjustment until the rubber button is compressed $\frac{1}{8}$ " and tighten the lock nut.

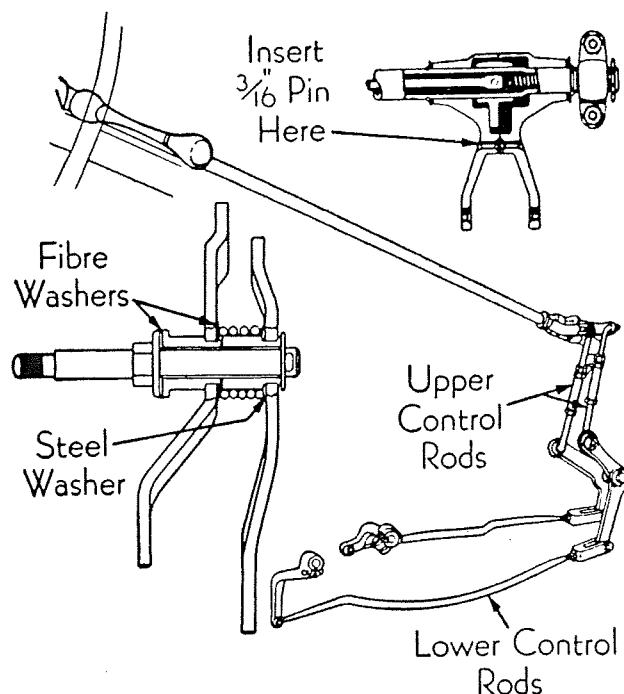


Fig. 31—Packard 1939-40. 1941-42 is Similar

PLYMOUTH

SHIFT CONTROL ROD, ADJUST

1939: (See Fig. 21, page 8.) (1)—Disconnect the control rod from the shift lever at the transmission. (2)—Set the hand control lever and the transmission gears in neutral. (3)—Adjust the length of the rod by turning its threaded end up or down into the adjustable joint until the rod slips freely into the lever, when the lever is held toward the rear of the transmission. (4)—Tighten the lock nut.

1940: (1)—Loosen the lock bolt which fastens the lever on the lower end of the steering column. (2)—Set the transmission gears in neutral and position the hand control lever 10 degrees above the horizontal, and tighten the lock bolt.

1941-42 MANUAL SHIFT: (See Fig. 22, page 9.) (1)—Loosen the lock bolt at the upper lever on the lower end of the steering column. (2)—Set the transmission gears in neutral and position the hand control lever in a horizontal position, and tighten the lock bolt.

GEARSHIFT, ADJUST

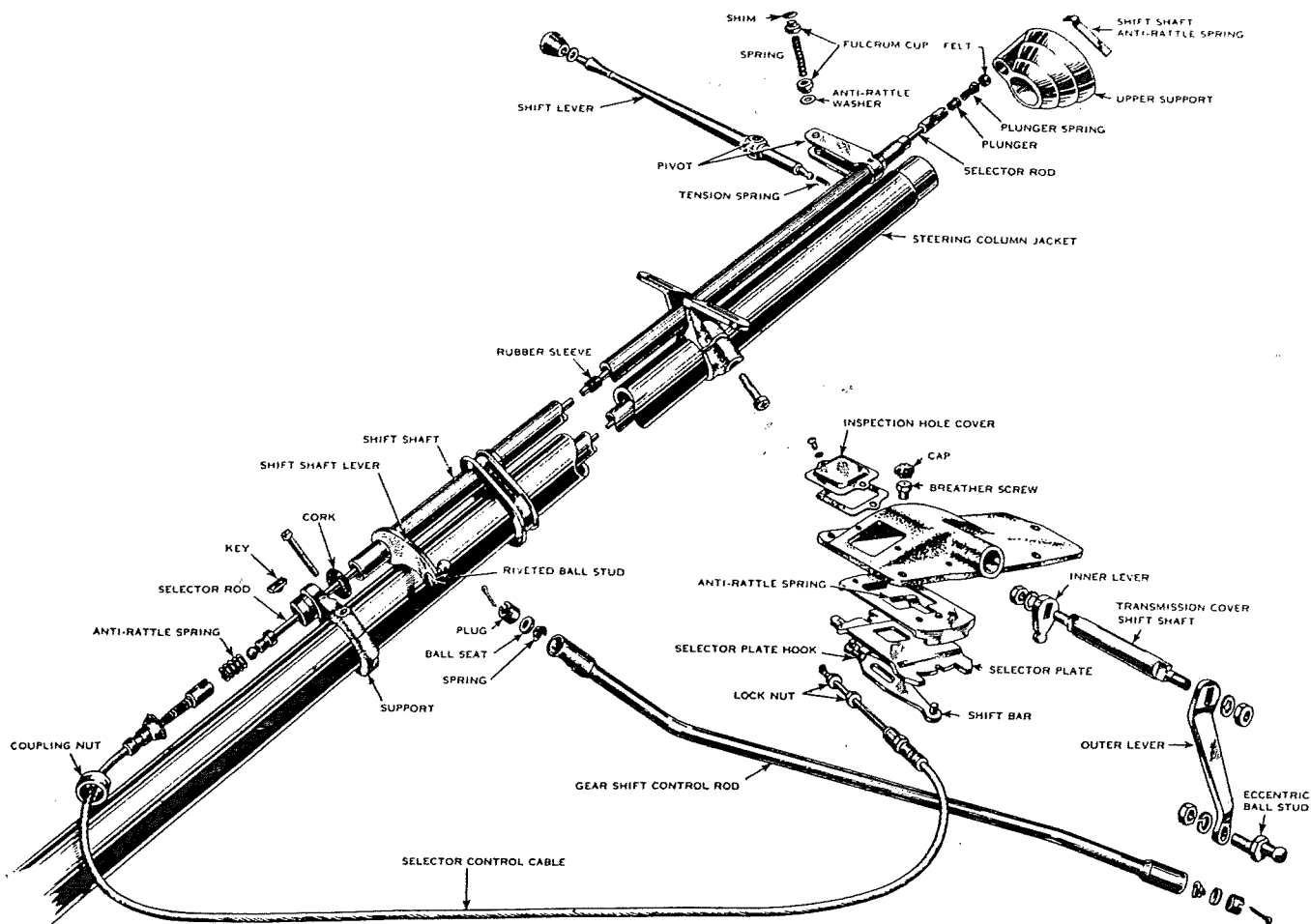


Fig. 32—Pontiac 1938

SHIFT SELECTOR, ADJUST

1939: (See Fig. 21, page 8.) (1)—Loosen the clamp screw at the transmission end of the cable. (2)—Set the hand control lever in neutral and loosen the ferrule screw—which is just below the clamp screw—until end play develops between the plunger end of the cable and the clover-leaf plate. (3)—Then tighten the screw just enough to eliminate end play. NOTE—Do not tighten too much, otherwise excessive wear will develop at the end of the cable and the plate. (4)—When adjusted properly, tighten the clamp screw.

1940: (1)—With the transmission gears in neutral, loosen the lock nut at the transmission end of the cable. (2)—Tighten the acorn nut until all play is removed from the cable, then back off the nut $\frac{1}{2}$ turn for clearance. (3)—Tighten the lock nut.

1941-42 MANUAL SHIFT: (1)—Set the transmission gears in neutral and loosen the lock nut on the selector rod at the transmission end. (2)—Tighten the nut until all play is removed and back off $\frac{1}{2}$ turn for clearance. (3)—Tighten the lock nut.

POWER SHIFT ADJUSTMENTS

1941-42 VALVE ACTION, ADJUST: (See Fig. 23.) (1)—To adjust the vacuum cylinder valve, remove the boot and valve clevis pin. (2)—If the shift is sluggish into second or reverse, screw the clevis OUT on the valve rod. (3)—If sluggish into first or third, screw the clevis IN on the valve rod. NOTE—When making adjustments, screw the clevis $\frac{1}{2}$ turn at a time in the desired direction until proper valve action is obtained. This precaution is necessary to avoid the possibility of creating a sluggish valve action in the opposite speeds when trying to eliminate the condition in those speeds being adjusted.

1941-42 NEUTRAL POSITION, ADJUST: (1)—Remove selector rod. (2)—Slacken the detent spring screw in the reaction levers. (3)—With engine running to provide a source of vacuum, and with wheels off the ground, move the power lever and links back and forth a very small amount. At the same time, move the selector arm until a clean and positive crossover is felt in this position. (4)—Then move the detent

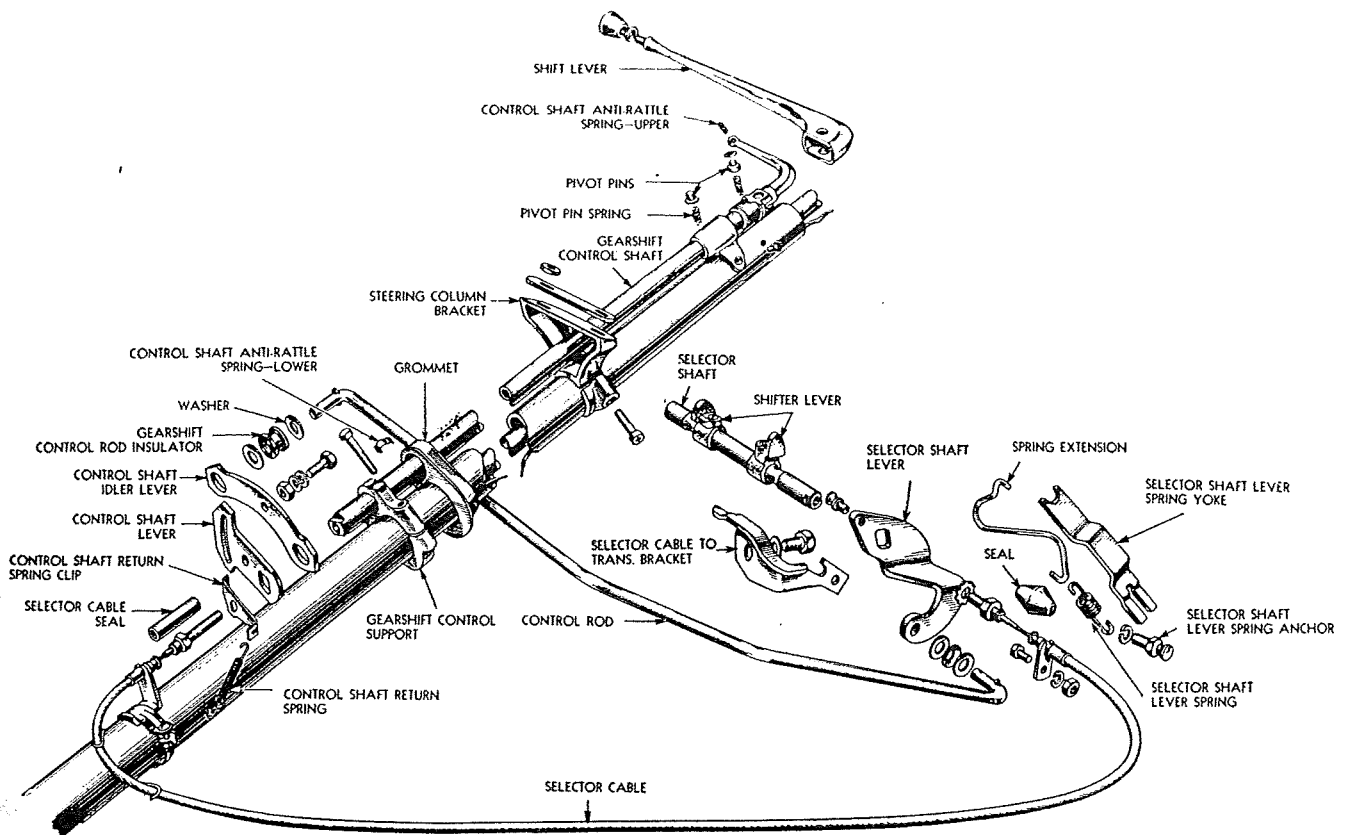


Fig. 33—Pontiac 1939

spring until the boss indexes the notch in the lever, and tighten the bracket clamp bolt. (5)—Connect and adjust the selector rod as already described for MANUAL SHIFT.

PONTIAC

1938: (See Fig. 32.) To maintain the position of the hand control lever, two adjustments are provided, namely: selector position and engagement position. To adjust the selector position: (1)—Set the hand control lever and transmission gears in neutral. (2)—Take out the front floor center plate. (3)—Remove the inspection hole cover from the transmission cover. (4)—There are two lock nuts at the end of the selector cable where it is attached to a hook on the selector plate inside the transmission case. Turn the lock nuts in the desired direction until the distance between the hand control lever and the rim of the steering wheel is as shown in Fig. 36. NOTE—Turning the nuts toward the end of the control cable increases the distance. (5)—Tighten the lock nuts securely and replace the inspection hole cover and center floor plate.

To adjust the engagement position: (1)—Loosen the lock nut on the eccentric ball stud located at the transmission outer lever. (2)—Turn the stud until the

shift lever is in a horizontal position. (3)—Tighten the ball stud lock nut securely.

NOTE—If the shift control rod has been disassembled, assemble the parts and screw the end plugs firmly against their seats and back off from $\frac{1}{8}$ to $\frac{3}{8}$ turn and install cotter pins.

1939-42: (See Fig. 33 for 1939 and Fig. 34 for 1940-42.) A clearance of $\frac{1}{8}$ " must be maintained between the shoulder on the control shaft upper bearing (Fig. 35) and the top of the support so there will be no interference at this point when selecting gears. Screwing the bearing out of the support $\frac{1}{2}$ turn increases this clearance $\frac{1}{32}$ ".

On 1939 cars, adjustment of the shift lever position with relation to the steering wheel rim is provided by a screw at the lower end of the control shaft, below the idler lever. This screw is swiveled on the end of the selector cable and has a rubber cover. Backing out this screw raises the lever, and screwing it in, lowers the lever. The distance between the shift lever and the rim of the steering wheel should be from $2\frac{7}{8}$ " to $3\frac{1}{8}$ ", and is measured in the same manner as shown in Fig. 35 for 1940-42 cars. When this dimension is obtained, tighten the lock nut securely and replace the rubber cover.

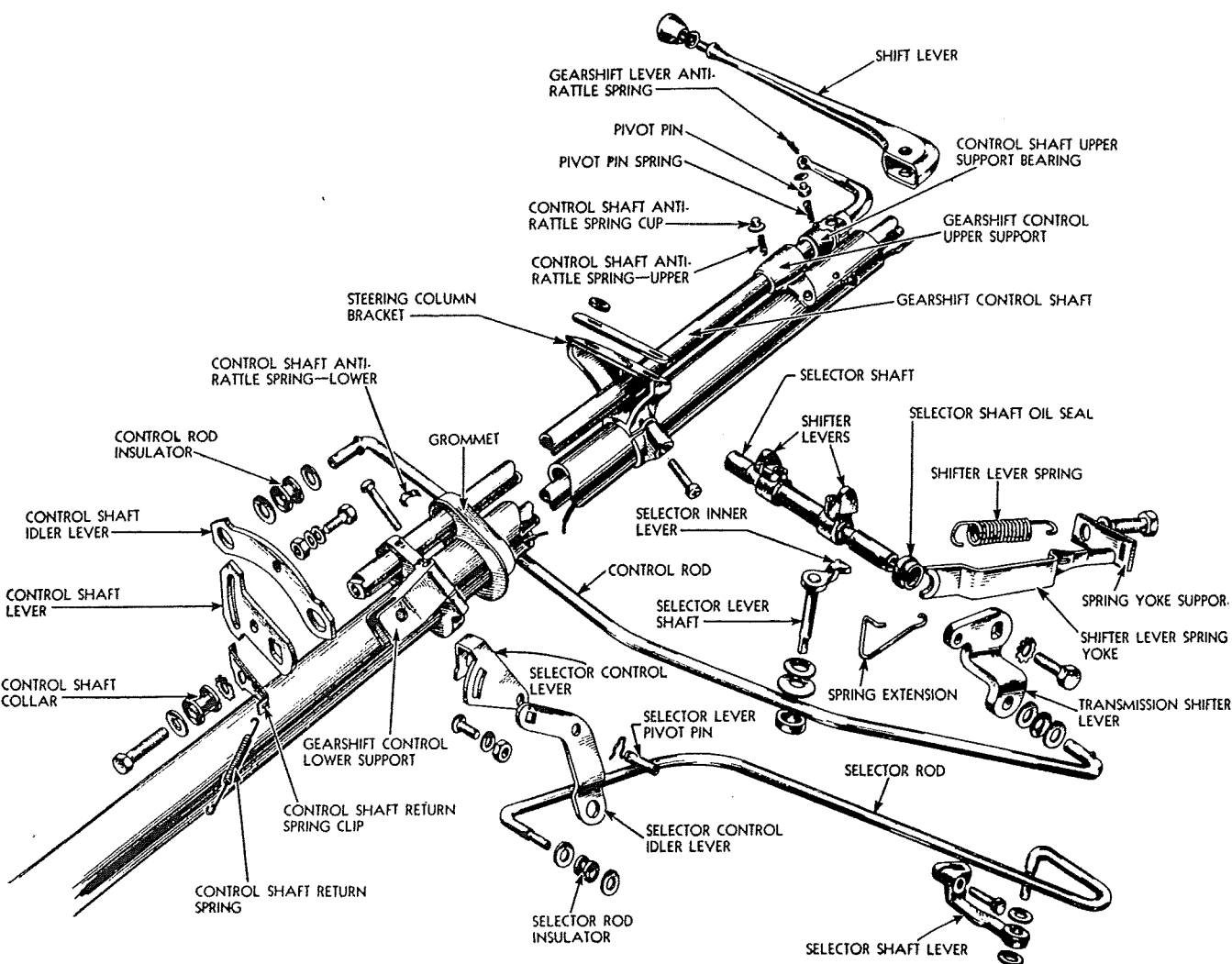


Fig. 34—Pontiac 1940-42

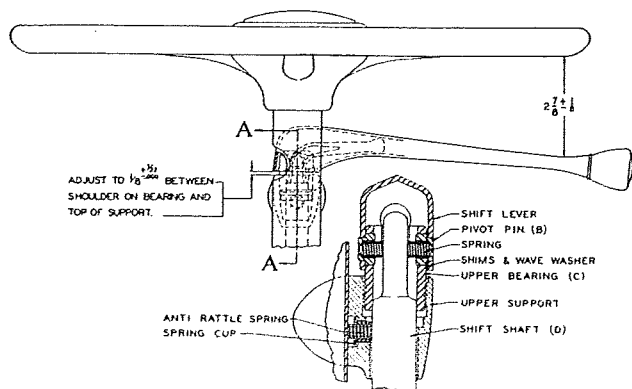


Fig. 35—Pontiac 1940-42.
Gearshift Lever Adjustment

On 1940-42 cars, this shift lever position should be adjusted as shown in Fig. 35. To make the adjustment, loosen the adjusting bolt which clamps the selector control lever to the idler lever. Move the shift lever

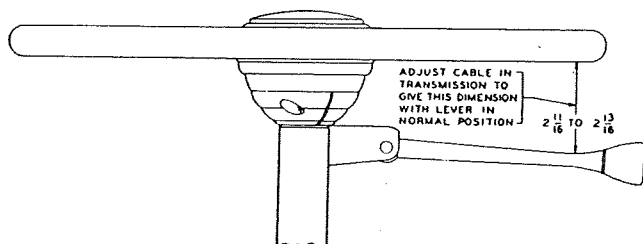


Fig. 36—Pontiac 1938. Gearshift Lever Adjustment

to the desired position while holding the selector rod in the second and high position, then tighten the bolt.

On all 1939-42 models, the control lever may be lowered a maximum of 1½" from the horizontal—measured from the control lever knob. To move the lever toward or away from the driver, loosen the clamp bolt which holds the idler lever to the control shaft lever. Then move the control lever to the desired position and tighten the bolt.

STUDEBAKER

1939 Commander & President: (See Fig. 37.) (1)—Disconnect the control rods from the levers on the transmission side cover. (2)—Place the hand control lever in the neutral position, which is determined by

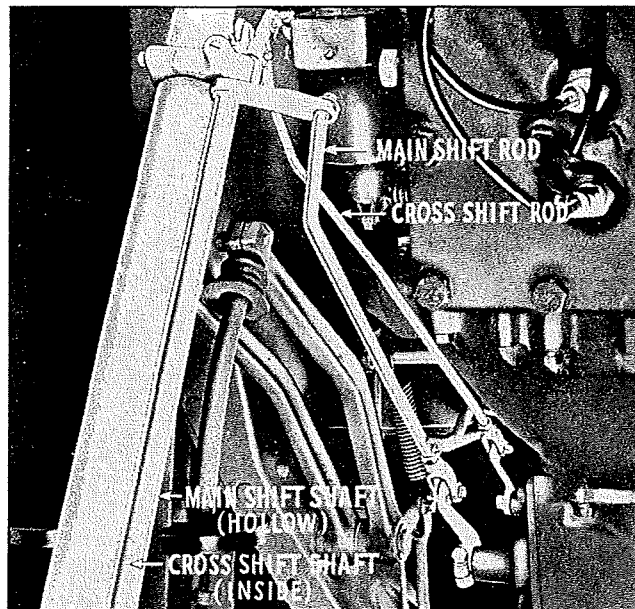


Fig. 37—Studebaker Commander and President 1939

feel when the interlocking poppet ball engages the notch in the control shaft. (3)—Disconnect the cross shift rod from its bellcrank. (4)—Place the hand control lever parallel with the steering wheel and turn the cross shift rod in its clevis until the upper edge of the slot in the clevis just lines up with the lower face of the lower bracket (on steering column). (5)—Replace the clevis pin. (6)—Now hold the small lever on the transmission side cover in its forward position and adjust the length of the cross shift rod so that the clevis pin will just enter the clevis and the hole in the small lever. (7)—Guided by feeling the action of the shift rail detents, set the large lever on the transmission cover in the neutral position. (8)—Adjust the length of the main shift rod so that the clevis pin will just enter its clevis and the hole in the large lever.

1939 Champion & All 1940-42: (See Fig. 38.) NOTE—In checking the adjustment and position of the gearshift rods, the steering column jacket must be rotated, if necessary, to obtain approximately $\frac{1}{16}$ " to $\frac{1}{8}$ " clearance between the gearshift control shaft and the instrument panel.

(1)—Place the steering post linkage in exactly the neutral position when making an adjustment of the shift rods. This position can be obtained by using a special adjusting gauge for each year. NOTE—The 1939 gauge can be changed for use on 1940-42 cars by grinding .039" off each side of the outside face of the gauge forks. (2)—Remove the pry-out plug in the shift control box and insert the gauge by pushing up on

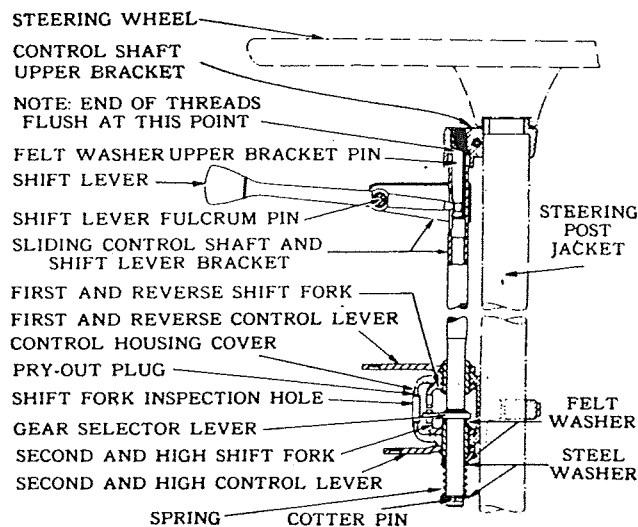


Fig. 38—Studebaker Champion 1939 and All 1940-42

the lower end of the shift control shaft. (3)—With the gauge in position, disconnect both rods from the levers at the transmission. (4)—Move the levers at the transmission in the neutral position as determined by the action of the detent plungers in the transmission. (5)—Adjust the length of the rods by turning the threaded clevis until the clevis pins can be installed in the shift levers without disturbing the position of the levers.

WILLYS

1940-42: (See Fig. 39.) (1)—To make an adjustment, shift the hand control lever to its neutral position. (2)—Align the pinholes in the levers at the bottom of the main shifting rod to hold them in their neutral positions. (3)—Disconnect the control rods from the levers at the transmission and place the transmission levers in neutral. (4)—Finally, adjust the length of the control rods so that they will just slip into their respective levers on the transmission without moving the levers from their neutral position.

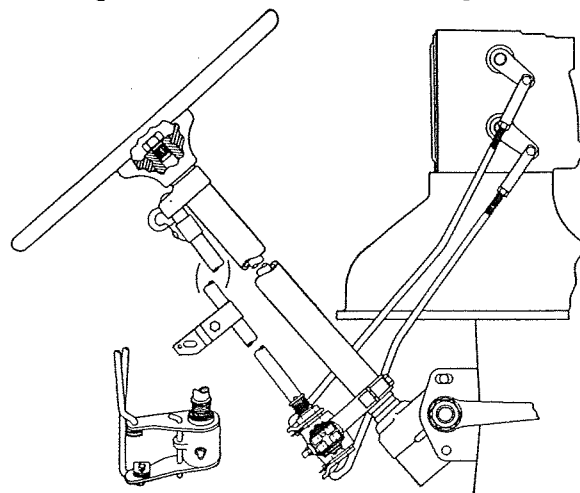


Fig. 39—Willys 1940-42

TRANSMISSION REMOVE AND REPLACE

Passenger Cars

INDEX

Car Make	Page	Car Make	Page	Car Make	Page
AUBURN	18	HUDSON	24	PACKARD	26
BUICK	18	HUPMOBILE	24	PIERCE ARROW	26
CADILLAC	19	LA FAYETTE	25	PLYMOUTH	26
CHEVROLET	20	LA SALLE	19	PONTIAC	27
CHRYSLER	21	LINCOLN	25	REO	28
DE SOTO	22	LINCOLN-ZEPHYR	25	STUDEBAKER	28
DODGE	23	MERCURY	25	TERRAPLANE	24
FORD	24	NASH	25	WILLYS	29
GRAHAM	24	OLDSMOBILE	25		

AUBURN

1935-36: (1)—Take out the floor boards. (2)—Disconnect the free wheel control wire at the unit (if equipped). (3)—Disconnect the speedometer cable. (4)—Unbolt the propeller shaft at the front universal joint flange. (5)—Remove the hand brake lever. (6)—Remove the bolts which attach the transmission to the clutch housing and insert pilot studs in the two top holes. (7)—Slide the transmission straight back on the guide studs until the main drive gear shaft is free of the clutch disc hub.

Install the unit in the reverse order of removal, being sure to use the pilot studs in order to guide the assembly safely into place.

BUICK

1935-38: (1)—Take out the floor boards. (2)—Disconnect the speedometer cable. (3)—On 1935 series 60 and 90, remove the shift lever from the shift lever housing, then take off the transmission cover. On all other models, remove the shift lever and transmission cover as an assembly. (4)—Remove the rear axle assembly. (5)—On 1935 cars, detach the brake controls from the transmission. (6)—On all cars, remove the transmission support, being sure to note the position and quantity of shims removed so that they may be replaced as originally installed. (7)—On 1938 series 60, 80 and 90, disconnect the transmission steady rest rod. (8)—On 1935 series 60 and 90, remove the flywheel underpan in order to gain access to the two nuts on the lower mounting bolts; then remove all the mounting bolts which attach the clutch housing to the flywheel housing. Insert guide studs in two of the upper mounting holes. On all other models, remove the two top transmission mounting bolts and insert guide

studs in their place; then take out the lower mounting bolts. (9)—On all series, slide the transmission straight back on the guide studs until the main drive gear shaft is free of the clutch disc hub.

Assemble in the reverse order of removal, being sure to use the pilot studs to guide the assembly safely into place.

1939-1942: (1)—Remove the cover from the floor over the transmission. (2)—Disconnect the speedometer cable. (3)—Disconnect the shift control rods from the levers at the transmission; and on 1941 series 40 and 50 models, remove the levers also. (4)—Remove the rear axle assembly. (5)—Remove the transmission steady rest rod and the transmission support, noting the quantity and position of the shims so that when assembled, the original installation is maintained.

NOTE: On 1941 cars, support the rear of the engine, using special engine jacks placed on each side of the rear engine mounting, locating the pilot end of the jacks in the holes in the flywheel housing, with the bottom of the jacks resting on the frame cross member.

(6)—On all models, remove the two top transmission mounting bolts and insert guide studs in their place. (7)—Take out the lower mounting bolts. (8)—Slide the transmission straight back on the guide studs until the main drive gear shaft is free of the clutch disc hub.

NOTE: On 1941 models, before removing the transmission, relieve any strain on the rear engine mounting bolts by either raising or lowering the special jacks already mentioned.

Replace the transmission in the reverse order of removal, being sure to use the pilot studs in order to guide the assembly safely into place.

NOTE: On 1941 cars, since the transmission support mounting is a part of the engine mounting ar-

TRANSMISSION, REMOVE and REPLACE

rangement, make sure that the support is adjusted so that no upward or sidewise tension is placed on the transmission.

When the transmission is completely installed, connect and adjust the shifter mechanism as described under GEARSHIFT, ADJUST, see page 1.

CADILLAC & LA SALLE

1935-36: (1)—Remove floor boards. (2)—Disconnect speedometer cable. (3)—Disconnect rear universal joint and remove propeller shaft. (4)—On Cadillac cars only, remove the transmission rear support together with the cross member—bolted to the frame—that carries this support. (5)—On all cars, remove the front propeller shaft housing together with the front propeller shaft and universal joint. NOTE: This assembly need not be removed at this time on La Salles and Cadillac 36-60, but to lighten the load and facilitate handling of the transmission, it is recommended that it be done. (6)—On all Cadillacs, except 36-60, disconnect the clutch release mechanism. (7)—On La Salles and Cadillac 36-60, remove the transmission mounting bolts and insert two guide studs in the two top holes. On the other models, remove all the mounting bolts and install guide studs in the holes provided at each side of the transmission case. (8)—Remove the unit by pulling it straight back on the guide studs until the main drive gear is free of the clutch disc hub.

NOTE: On La Salles and 36-60 Cadillac, if the transmission is to remain out of the car for a long period of time, care should be exercised to prevent the main drive gear assembly from slipping out of place. Since this assembly is loose in the case and, when the transmission is out of the car, it is free to slip out far enough for the fingers of the high speed synchronizing drum to pull out of the splines in the mainshaft. To prevent this condition, either keep the transmission in high gear all the time it is out of the car, or, as an extra precaution, install a brace across the face of the transmission case to hold the main gear assembly in position.

Installation is made in the reverse order of removal, but be sure to use the guide studs in order to guide the assembly safely into place.

1937 EXCEPT V 16: (1)—Remove floor boards. (2)—Jack up the engine—placing the jack under the oil pan next to the drain plug, using a wooden block to avoid damage to the oil pan. (3)—Disconnect the propeller shaft at the front universal joint, and the transmission extension at the rear engine support. (4)—Detach the engine support stabilizer (not on 37-50 & 60) on the right hand side of the transmission by removing the pin on the forward end. (5)—Unfasten the exhaust pipe brace from the transmission case. (6)—Remove the transmission support cross member. (7)—Disconnect the speedometer cable. (8)—Remove the transmission mounting bolts and insert guide studs in the upper holes. (9)—Slide the unit straight back

on the guide studs. NOTE: As soon as the transmission is moved back far enough to gain access to the drain hole for the main drive gear bearing, insert a 1/4" cork plug to prevent loss of the lubricant. (10)—Remove the transmission.

Replace the transmission in the reverse order, being sure to use the pilot studs to guide the assembly safely into place. Be sure also, to remove the cork plug from the drain hole before installing the unit all the way into position.

1937, V-16: (1)—Remove the propeller shaft together with the front and rear universal joints. (2)—Take out the floor boards. (3)—Unclip the vacuum brake booster line from the top of the transmission. (4)—Remove the starting motor. (5)—Unbolt the transmission support cross member. (6)—Disconnect the clutch release yoke. (7)—Remove the front propeller shaft and housing from the transmission. NOTE: To prevent loss of lubricant, insert a cork plug in the oil hole at the rear of the transmission case. (8)—Remove all transmission mounting bolts and place guide pins in the holes provided at each side of the case. (9)—Slide the transmission straight back until the main drive gear shaft is free of the clutch disc hub.

Replace in the reverse order of removal but be sure to use the pilots to guide the assembly safely into place. Be sure also, to remove the cork plug from the back of the case before installing the front propeller shaft and housing; failure to do so will prevent lubrication of the speedometer gears and the front propeller shaft bearing.

1938-42: Not necessary to remove floor boards. (1)—Support the engine with a jack placed at the back end of the oil pan—near the drain plug—using a block of wood to avoid damaging the pan. NOTE: This is not required on the V-16's as these models have five engine supports. (2)—Remove the propeller shaft together with the front and rear universal joints. (3)—Disconnect the transmission support at the rear of the extension housing. (4)—Remove the transmission support cross member. (5)—Detach the shift control rods from the levers at the transmission. (6)—remove the transmission mounting bolts and insert guide studs in the top holes. (7)—Slide the transmission straight back on the guide studs. NOTE: As soon as the transmission is moved back far enough to gain access to the drain hole for the main drive gear bearing, insert a cork plug in the hole to prevent loss of the lubricant. (8)—Remove the transmission by lowering it to the floor.

Install the transmission in the reverse order of removal, using the pilot studs to guide the assembly safely into place. Be sure also, to remove the cork plug from the main drive gear bearing drain hole. After the assembly is completely installed, connect the shift control rods to the levers at the transmission and adjust the mechanism as described under GEARSHIFT, ADJUST, see page 2.

TRANSMISSION, REMOVE and REPLACE

CHEVROLET

1935-36 STANDARD MODELS: (1)—Remove floor boards. (2)—Disconnect brake rods at rear axle housing. (3)—On 1936 cars, detach hydraulic brake lines at the rear wheels. (4)—On all models, remove "U" clamps from rear axle and springs. (5)—Slide the rear axle back until the propeller shaft is free from the universal joint. (6)—Disconnect hand brake lever. (7)—Detach speedometer cable. (8)—Uncouple the transmission from the cross member. (9)—Remove the two top transmission mounting bolts and insert guide studs in their place. (10)—Remove the flywheel underpan to gain access to the lower transmission mounting bolt nuts, and remove these bolts. (11)—Slide the transmission straight back on the guide studs until the main drive gear is out of the clutch disc hub.

Replace the transmission in the reverse order of removal, being sure to use the pilot studs to guide the assembly safely into place.

1935-36 MASTER MODELS: (1)—Take out the floor boards. (2)—Disconnect the speedometer cable. (3)—Unfasten the hand brake lever from the frame. (4)—Unbolt the universal ball collar and slide the ball and collar back on the propeller shaft. (5)—Split the universal joint by removing the nuts from the universal joint ring. (6)—Remove the two top transmission mounting bolts and insert guide studs in their place. (7)—Take off the flywheel underpan to gain access to the two lower transmission bolt nuts, and remove these bolts. (8)—Disconnect the rear of the transmission from the frame. (9)—Slide the transmission straight back on the guide studs until the main drive gear is out of the clutch disc hub.

Replace in the reverse order of removal, being sure to use the pilot studs in order to guide the assembly safely into position.

1937-39: (1)—Remove the front floor pan over the transmission. (2)—Disconnect the three pull rods from the brake cross shaft. (3)—Detach the left cross shaft bracket and take off the cross shaft. (4)—Uncouple the speedometer cable.

(5)—On 1939 cars with vacuum gearshift, disconnect the control as follows: (a)—Untie the boot wires on the shifter operating lever and at the front of the rubber bellows. (b)—Remove the clevis pin from the shift control rod and take off the boot. (c)—Disconnect the selector control rod from the selector lever. (d)—Uncouple the clevis pin from the piston rod yoke and shifter operating lever. (e)—Disconnect the vacuum valve pull rod links.

(6)—Continue on 1937-39 cars by placing a jack under the propeller shaft housing for support while the universal joint is being disconnected. (7)—Unbolt the universal ball collar and slide the ball and collar back on the propeller shaft. (8)—Split the universal joint by removing the nuts from the joint ring. (9)—

Lower the jack under the propeller shaft housing until downward pressure is relieved. (10)—Take out the two top transmission mounting bolts and insert guide studs in their place. (11)—Remove the flywheel underpan and unscrew the two lower bolts and nuts which fasten the lower end of the transmission to the clutch housing. (12)—Slide the transmission straight back on the guide studs until the main drive gear is out of the clutch disc hub.

Replace the transmission in the reverse order, being sure to use the pilot studs to guide the assembly safely into place. For complete service instructions on the vacuum gearshift, see the GEARSHIFT, ADJUST chapter, page 3.

1940-42 EXCEPT 1941-42 CABRIOLET:

(1)—Remove the metal cover from the floor over the transmission.

(2)—On 1940 cars, disconnect the shift control as follows: (a)—Uncouple the shift control rod from the reactionary lever. (b)—Take off the hose from the vacuum cylinder inlet stack. (c)—Slip the forward end of the rubber boot off the rear end of the metal boot. (d)—Unbolt the two halves of the metal boot and lift off the top half. (e)—Detach the piston rod yoke clevis. (f)—Push the piston rod into the vacuum cylinder to disconnect it from the reactionary levers. (g)—To maintain the vacuum valve adjustment, replace the clevis pin through the piston rod yoke and valve link. (h)—Remove the vacuum cylinder from its mounting.

(3)—On 1941 cars, disconnect the shift control as follows: (a)—Split the two halves of the metal boot and remove the outer half. (b)—Loosen the vacuum cylinder bracket from the transmission, and the clamp which holds the reactionary lever assembly to the transmission operating shaft. (c)—Carefully drive the assembly from the end of the shaft. (d)—Disconnect the selector rod from the selector lever at the transmission end. (e)—Now, remove the bolts which were previously loosened at the vacuum cylinder bracket, and move the entire assembly away from the transmission.

NOTE: Steps 4 to 13 inclusive cover all 1940-42 Chevrolets.

(4)—Continue on 1940-42 cars by disconnecting the pull rod and brake cables from the brake cross shaft, then remove the shaft. (5)—Remove the speedometer cable and driven gear assembly. (6)—Unscrew the universal ball collar from the retainer and slip the ball and collar back on the propeller shaft housing. (7)—Remove the two universal front yoke trunnion bearings and split the universal joint. (8)—Push down on the front end of the propeller shaft for clearance when removing the transmission. (9)—Detach the transmission from the frame cross member. (10)—Remove the two top bolts which fasten the transmission to the

TRANSMISSION, REMOVE and REPLACE

clutch housing and install guide studs in their place. (11)—Take off the flywheel underpan and remove the two lower transmission mounting bolts. (12)—Slide the transmission straight back on the guide pins until the main drive gear is out of the clutch disc hub. (13)—Lift the transmission out through the opening in the body floor.

Replace the unit in the reverse order of removal, being sure to use the pilot studs to guide the assembly safely into place. See the GEARSHIFT, ADJUST chapter for complete service instructions on these cars, page 6.

1941-42 CABRIOLET: Due to the difference in frame design, the removal procedure is slightly different from the closed models. (1)—Remove the metal cover from the body floor over the transmission. (2)—Uncouple the two halves of the reactionary metal boot and remove the outer half. (3)—Disconnect the selector rod from the selector lever. (4)—Remove the cotter pin, washer and anti-rattle spring from the transmission end of the shift control rod and disconnect the rod. (5)—Disconnect the vacuum cylinder piston rod and valve link from the reactionary levers. (6)—To maintain the vacuum valve adjustment, replace the clevis pin through the piston rod yoke and valve link. (7)—Remove the vacuum cylinder from its mounting.

The balance of the removal procedure is the same as described for the closed cars and covered by items 4 to 13. Then remove the transmission by rotating it to the left as necessary to provide clearance in lifting it up through the opening in the body floor.

CHRYSLER

1935-38 WITH AND WITHOUT OVERDRIVE:

(1)—Take out the floor boards. (2)—Disconnect the battery cable at the transmission. (3)—Remove the propeller shaft and universal joint assembly. (4)—Disconnect the overdrive control cable (if equipped). (5)—Detach the speedometer cable. (6)—Disconnect the hand brake rod on 1935-37 cars; or the hand brake cable on 1938 cars. (7)—On the C18 model, if equipped with overdrive, remove the hand brake band. (8)—On the C19, if equipped with overdrive, take off the hand brake band and the brake drum. (9)—On C19 and C20 cars, before removing the rear engine mountings, support the engine with a jack. (10)—Take off the transmission cover and shift lever assembly. (11)—Unhook the pull-back spring from the clutch release fork. (12)—Disconnect the release fork rod.

(13)—NOTE: On models C1, C2, C3, C9, C10, C11, C15, C17 and C20, it is not necessary to remove the release fork; merely turn it backward so it will clear the clutch release bearing when the transmission is being removed. On models CZ, C6, C7, C8, remove the release fork pivot screw (clevis pin on C14, C16) and pull the release fork out of the housing.

(14)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (15)—Remove the two upper studs and insert pilot studs in their place. (16)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (17)—Lower the transmission to the floor.

Reverse the order of procedure to install the unit, being sure to use the pilot studs to guide the assembly safely into position.

1939 WITHOUT OVERDRIVE: (1)—Remove the floor boards. (2)—Detach the battery cable at the transmission. (3)—Remove the propeller shaft assembly. (4)—Disconnect the hand brake cable. (5)—Uncouple the speedometer cable. (6)—Disconnect the gearshift control rod and cable at the transmission. (7)—Take off the transmission cover. (8)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (9)—Remove the upper studs and insert pilot studs in their place. (10)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (11)—Lower the unit to the floor.

Replace the unit in the reverse order of removal, using the pilot studs to guide the assembly safely into place. See the GEARSHIFT, ADJUST chapter for service instructions. See page 8.

1939 WITH OVERDRIVE: NOTE: In order to avoid the loss of lubricant when tilting the assembly during its removal, it is necessary to drain the lubricant from both the transmission and overdrive units.

(1)—Remove the floor boards. (2)—Detach the battery cable at the transmission. (3)—Remove the propeller shaft assembly. (4)—Take off the universal joint flange and brake drum from the overdrive mainshaft. (5)—Disconnect the brake cable at the lower end. (6)—Unbolt the brake band and brake support from the overdrive case and lift off the brake assembly. (7)—Disconnect the wires and remove the solenoid unit. (8)—Uncouple the speedometer cable. (9)—Detach the gearshift rod and cable from the transmission. (10)—Unfasten the overdrive control cable clevis from the lever. (11)—Disconnect the transmission cover from the clutch housing.

(12)—NOTE: On C23 and C24 models, support the rear of the engine with a jack just enough to relieve the load on the rear supports at the sides of the transmission. It is important that the car be standing level, because, by raising only the front end of the car, the power plant will shift toward the rear, which is caused by rocking on the rubber front support. This backward movement will most likely prevent the removal of the assembly as well.

(13)—Then, loosen, but do not remove the transmission side supports at the frame on C23 and C24 cars. (14)—Use a jack to support the transmission and overdrive assembly to take the load off the transmission

TRANSMISSION, REMOVE and REPLACE

support brackets and then, remove the bolts which fasten the brackets to the frame. (15)—Remove the nuts from the studs which attach the transmission to the clutch housing. (16)—Remove the two upper studs and install pilot studs in their place. (17)—Now remove the transmission supports which were previously loosened on C23 and C24 cars.

NOTE: The assembly is removed by sliding the unit back on the guide studs. Then, while pulling it back, rotate the unit so that its right side is facing the top. When the main drive gear end is free of the clutch release bearing, tip the front end of the assembly upward and push it forward so that the shaft goes above the release bearing and between two clutch levers. Then lower the rear end of the unit and pull it back out of the car.

Replace the assembly in the reverse order of removal, being sure to use the pilot studs to guide the assembly safely into place. See the GEARSHIFT, ADJUST chapter for service instructions. See page 8.

1940-42 THREE-SPEED, WITH AND WITHOUT OVERDRIVE: **NOTE:** It is not necessary to remove the floor boards. (1)—On overdrive units, drain the lubricant from both the transmission and overdrive. (2)—Raise the car at the front and place jacks under the lower control arms. (3)—On cars without overdrive, disconnect the propeller shaft at the front. (4)—For cars with overdrive, disconnect the front and rear universal joints. (5)—On all cars, if the transmission is to be disassembled, loosen the companion flange nut. (6)—Uncouple the speedometer cable. (7)—Disconnect the hand brake cable at the brake band. (8)—On overdrive units, remove the wires and take off the solenoid unit. (9)—Detach the gearshift control rods from the transmission. (10)—If equipped with power shift, remove the vacuum and air hose and take off the gearshift selector rod. (11)—On overdrive units, disconnect the overdrive control cable clevis at the lever on the overdrive case. (12)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (13)—Unscrew the two upper studs and install pilot studs in their place. (14)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (15)—Lower the assembly to the floor.

Assemble in the reverse order, being sure to use the pilot studs to guide the assembly safely into place. See the GEARSHIFT, ADJUST chapter for service instructions. See page 8.

1941-42 FOUR SPEED: (1)—Take out the floor board. (2)—Uncouple the speedometer cable. (3)—Detach the wires from the vacuum unit solenoid, the interrupter switch and the governor switch. (4)—Take off the hose which is between the vacuum unit air cleaner and the vacuum unit. (5)—Disconnect the vacuum line hose between the engine manifold and the vacuum unit. (6)—Unfasten the vacuum unit pull-out

cable and return spring. (7)—Remove the pivot pin and take out the vacuum unit. (8)—Detach the hand brake cable at the brake band. (9)—Disconnect the propeller shaft at the front universal and push back the yoke. (10)—Detach the gearshift control rod and selector cable at the transmission. (11)—Remove the nuts from the transmission mounting studs. (12)—Take out the two upper studs and insert guide pins in their place. (13)—Slide the transmission straight back on the guide pins until the main drive gear is out of the clutch disc hub. (14)—Lower the unit to the floor.

Assemble in the reverse order, being sure to use the guide studs to pilot the assembly safely into position.

DE SOTO

1935-38 WITH AND WITHOUT OVERDRIVE:

(1)—Take out the floor boards. (2)—Disconnect the battery cable at the transmission. (3)—Remove the propeller shaft and universal joint assembly. (4)—Disconnect the overdrive control cable (if equipped). (5)—Detach the speedometer cable. (6)—Disconnect the hand brake rod on 1935-37 cars; or the hand brake cable on 1938 cars. (7)—On 1938 models, if equipped with overdrive, remove the brake band. (8)—Take off the transmission cover and shift lever assembly. (9)—Unhook the pull-back spring from the clutch release fork. (10)—Disconnect the release fork rod.

(11)—**NOTE:** On the SG model, it is not necessary to take out the clutch release fork; merely turn it backward so it will clear the clutch release bearing when the transmission is being removed. On SF and 1936 cars, remove the release fork pivot screw (clevis pin on 1937-38) and pull the fork out of the housing.

(12)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (13)—Unscrew the two upper studs and insert guide studs in their place. (14)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (15)—Lower the transmission to the floor.

Install the unit in the reverse order of removal, being sure to use the pilot studs to guide the assembly safely into position.

1939 WITHOUT OVERDRIVE: (1)—Remove the floor boards. (2)—Detach the battery cable at the transmission. (3)—Remove the propeller shaft and universal joint assembly. (4)—Disconnect the hand brake cable. (5)—Uncouple the speedometer cable. (6)—Disconnect the gearshift control rod and cable at the transmission. (7)—Take off the transmission cover. (8)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (9)—Unscrew the two upper studs and insert pilot studs in their place. (10)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub.

Replace the unit in the reverse order, being sure to use the pilot studs in order to guide the assembly safely into position. See the GEARSHIFT, ADJUST chapter for service instructions. See page 9.

1939 WITH OVERDRIVE: NOTE: In order to avoid the loss of lubricant when tilting the transmission during its removal, it is necessary to drain the lubricant from both the transmission and overdrive units.

(1)—Remove the floor boards. (2)—Detach the battery cable at the transmission. (3)—Remove the propeller shaft assembly. (4)—Take off the universal joint flange and brake drum from the overdrive mainshaft. (5)—Disconnect the brake cable at the lower end. (6)—Unbolt the brake band and brake support from the overdrive case and lift off the brake assembly. (7)—Disconnect the wires and remove the solenoid unit. (8)—Uncouple the speedometer cable. (9)—Detach the gearshift rod and cable from the transmission case. (10)—Unfasten the overdrive control cable clevis from the lever. (11)—Disconnect the transmission cover from the clutch housing. (12)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (13)—Remove the two upper studs and install pilot studs in their place.

NOTE: The assembly is removed by sliding it back on the guide studs. Then, while pulling it back, rotate the unit so that its right side is facing the top. When the main drive gear end is free of the clutch release bearing, tip the front end of the assembly upward and push it forward so that the shaft goes above the release bearing and between two clutch levers. Then lower the rear end of the unit and pull it back out of the car.

Replace the assembly in the reverse order of removal, being sure to use the pilot studs to guide the assembly safely into position. See the GEARSHIFT, ADJUST chapter for service instructions. See page 9.

1940 WITH AND WITHOUT OVERDRIVE; 1941-42 THREE SPEED: NOTE: It is not necessary to remove the floor boards. (1)—On overdrive units, drain the lubricant from both the transmission and overdrive. (2)—Raise the car at the front and place jacks under the lower control arms. (3)—On cars without overdrive, disconnect the propeller shaft at the front. (4)—For cars with overdrive, disconnect the front and rear universal joints. (5)—On all cars, if the transmission is to be disassembled, loosen the companion flange nut. (6)—Uncouple the speedometer cable. (7)—Disconnect the hand brake cable at the brake band. (8)—On overdrive units, remove the wires and take off the solenoid unit. (9)—Detach the gearshift control rods from the transmission. (10)—If equipped with power shift, remove the vacuum and air hose and take off the gearshift selector rod. (11)—On overdrive units, disconnect the overdrive control cable clevis at the lever on the overdrive case. (12)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (13)—Unscrew the two upper

studs and install pilot studs in their place. (14)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (15)—Lower the assembly to the floor.

Assemble in the reverse order, being sure to use the pilot studs to guide the assembly safely into place. See the GEARSHIFT, ADJUST chapter for service instructions.

1941-42 FOUR SPEED: (1)—Take out the floor board. (2)—Uncouple the speedometer cable. (3)—Detach the wires from the vacuum unit solenoid, the interrupter switch and the governor switch. (4)—Take off the hose which is between the vacuum unit air cleaner and the vacuum unit. (5)—Disconnect the vacuum line hose between the engine manifold and the vacuum unit. (6)—Unfasten the vacuum unit pull-out cable and return spring. (7)—Remove the pivot pin and take out the vacuum unit. (8)—Detach the hand brake cable at the brake band. (9)—Disconnect the propeller shaft at the front universal and push back the yoke. (10)—Detach the gearshift control rod and selector cable at the transmission. (11)—Remove the nuts from the transmission studs. (12)—Take out the two upper studs and install pilot studs in their place. (13)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (14)—Lower the unit to the floor.

Assemble in the reverse order, being sure to use the pilot studs to guide the assembly safely into position.

DODGE

1935-39: (1)—Take out the floor boards. (2)—Disconnect the battery cable at the transmission. (3)—Remove the propeller shaft assembly. (4)—Detach the speedometer cable. (5)—Disconnect the hand brake rod or cable. (6)—On 1939 cars, detach the gearshift control rod and cable at the transmission. (7)—Take off the transmission cover, and on 1935-38 cars, remove the shift lever together with the cover. (8)—On 1935-38, unhook the pull-back spring from the clutch release fork and disconnect the release fork rod. (9)—On 1935-36 cars, remove the release fork pivot screw (clevis pin on 1937-38) and pull the fork out of the housing. (10)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (11)—Remove the two upper studs and install pilot studs in their place. (12)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (13)—Lower the transmission to the floor.

Assemble in the reverse order, being sure to use the pilot studs to guide the unit safely into position. See the GEARSHIFT, ADJUST chapter for service instructions on 1939 cars.

1940-42: NOTE: It is not necessary to remove the floor boards. (1)—Raise the car at the front end

TRANSMISSION, REMOVE and REPLACE

and place jacks under the lower control arms. (2)—Disconnect the propeller shaft at the front. (3)—If the transmission is to be disassembled, loosen the companion flange nut. (4)—Uncouple the speedometer cable. (5)—Disconnect the hand brake cable at the brake band. (6)—Detach the gearshift control rods from the transmission. (7)—If equipped with power shift, remove the vacuum and air hose and take off the gearshift selector rod. (8)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (9)—Unscrew the two upper studs and insert guide studs in their place. (10)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (11)—Lower the unit to the floor.

Assemble in the reverse order, being sure to use the pilot studs. See the GEARSHIFT, ADJUST chapter for service instructions. See page 10.

FORD

1935-42: (1)—Take out the floor boards. (2)—Detach the torque ball cap from the rear of the transmission. (3)—Remove the rear axle as described under REAR AXLE ASSEMBLY, REMOVE AND REPLACE. (4)—Disconnect the brake pedal rod. (5)—Unbolt the support member at the rear of the transmission. (6)—Place a jack under the flywheel housing and raise the engine about 2 or 3 inches. NOTE: Make sure the fan blades are set at a "V" position to avoid damage to the radiator core.

(7)—On 1940-42 cars, disconnect the gearshift rods from the levers at the transmission. (8)—Disconnect the transmission from the flywheel housing and slide the transmission straight back until the main drive gear is out of the clutch disc hub. Pilot studs should be used when removing or installing the transmission to avoid springing the clutch disc. (9)—Lower the transmission to the floor.

Assemble in the reverse order, and check the adjustment of the shifter mechanism on 1940-42 cars as described in the GEARSHIFT, ADJUST chapter. See page 10.

GRAHAM

1935-41: (1)—Remove the floor boards. (2)—Disconnect the front and rear universal joints and take out the propeller shaft assembly. (3)—If equipped with overdrive, disconnect the control wire from the lever at the side of the overdrive case. (4)—On 1939-41 cars, detach the shift control rods from the side of the transmission. (5)—Unfasten the transmission support. (6)—Detach the speedometer cable. (7)—Remove the transmission cover and shift lever assembly on 1935-38 cars. (8)—Disconnect the transmission from the clutch housing and insert pilot studs in the upper mounting holes. (9)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (10)—Remove the transmission by lowering it to the floor, or, if space permits, lift it out through the driver's compartment.

Install the assembly in the reverse order of removal, being sure to use the pilot studs to guide the unit

safely into position. See the GEARSHIFT, ADJUST chapter for service instructions on 1939-41 cars. See page 10.

HUDSON & TERRAPLANE

1935-42: (1)—Remove the front seat cushion. (2)—Detach the accelerator pedal by removing the clevis pins from the anchor bracket and the bell crank link. NOTE: If equipped with overdrive, fasten the accelerator pedal operating rod in such a manner that it will not drop on the starting motor or overdrive solenoid unit. Do this after removing the transmission floor cover. (3)—Remove the floor mat and transmission floor cover. (4)—Push the rubber steering column hole cover up on the column. (5)—On cars with floor-type gearshift, remove the transmission cover and shift lever assembly. (6)—On 1939-41 cars, disconnect the shift controls from the side of the transmission.

(7)—If equipped with "Electric Hand," remove the controls as follows: (a)—Disconnect the wires at the selector valve cover plate. (b)—Remove the clevis pins at the piston rod end, and at the power unit cross-shift rod. (c)—Disconnect the vacuum and air hose. (d)—Remove the power unit by unfastening it from its mounting bracket.

(8)—On all models, uncouple the speedometer cable. (9)—Disconnect the propeller shaft at the front universal. (10)—Unhook the clutch pedal return spring. (11)—Unbolt the clutch cross shaft. (12)—Remove the clutch control link clevis pin. (13)—Release the clutch pedal assisting spring. (14)—If equipped, loosen the inside nuts on the transmission side bumpers and remove the bumpers; then push the bumper rods out of the way. (15)—If equipped with overdrive, detach the wires from the solenoid unit; and the control cable clevis from the lever at the side of the overdrive case. (16)—Raise the car and remove the flywheel under-guard. (17)—Place a jack under the rear of the engine and raise it about $\frac{1}{2}$ inch. (18)—Remove the mounting bolts which fasten the clutch housing to the engine. (19)—Pull the assembly straight back until the main drive gear is out of the clutch disc hub. (20)—On cars with overdrive, lower the assembly onto a suitable dolly; and for standard transmissions, lift the assembly up through the floor opening.

Assemble in the reverse order. Guide studs should be used when removing or installing the assembly to avoid damaging the clutch disc. See the GEARSHIFT, ADJUST chapter for service instructions on 1939-41 cars. See page 11.

HUPMOBILE

1935-39: (1)—Remove the floor boards. (2)—Disconnect the front and rear universals and take out the propeller shaft assembly. (3)—If equipped with free wheel, disconnect the control wire at the unit. (4)—Uncouple the speedometer cable. (5)—Unfasten the transmission support from the transmission. (6)—Remove the transmission cover and shift lever assembly. (7)—Disconnect the transmission from the clutch

housing and insert pilot studs in the upper holes. (8)—Slide the assembly straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (9)—Remove the transmission by lifting it out through the opening in the floor.

Reverse the order of removal to install the assembly, being sure to use the pilot studs to guide the unit safely into position.

LA SALLE

See Cadillac

LINCOLN

1935-40: (1)—Take out the mat and floor board. (2)—Disconnect the propeller shaft at the flange to the rear of the universal joint. (3)—Uncouple the universal joint by removing the housing bolts and separating the housing. (4)—Disconnect the speedometer cable. (5)—Unfasten the brake pull rod. (6)—Unbolt the transmission support. (7)—Reach through the inspection hole in the bell housing and unhook the clutch release bearing pull-back spring. (8)—Remove the bolts which fasten the bell housing to the engine and insert pilot studs in two of the mounting holes. (9)—Pull the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (10)—Lift the transmission out through the driver's compartment.

Install the assembly in the reverse order, being sure to use the pilot studs to guide the assembly safely into position.

LINCOLN ZEPHYR

1936-41: (1)—Take out the floor boards. (2)—On 1936-37 cars, remove the transmission cover and shift lever assembly. (3)—On 1938-39 models, disconnect the instrument panel extension and the shift lever extension. (4)—On 1940-41, detach the gearshift control rods from the levers at the transmission. (5)—Unbolt the torque ball cap from the rear of the transmission. (6)—Remove the rear axle as described under REAR AXLE ASSEMBLY, REMOVE AND REPLACE. (7)—Disconnect the brake pedal rod. (8)—Unbolt the support at the rear of the transmission. (9)—Remove the mounting bolts which fasten the clutch housing to the engine. (10)—Reach through the clutch housing hand hole and unhook the clutch release bearing pull-back spring. (11)—Insert two pilot studs in the upper mounting holes and slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (12)—Lift the assembly out through the driver's compartment.

Install the unit in the reverse order of removal, being sure to use the pilot studs to guide the assembly safely into position. See the GEARSHIFT, ADJUST chapter for service instructions on 1940-41 cars. See page 11.

MERCURY

1939-42: (1)—Take out the floor boards. (2)—Detach the torque ball cap from the rear of the transmission. (3)—Remove the rear axle as described under

REAR AXLE ASSEMBLY, REMOVE AND REPLACE. (4)—Disconnect the brake pedal rod. (5)—Unbolt the support member at the rear of the transmission. (6)—Place a jack under the flywheel housing and raise the engine about 2 or 3 inches. NOTE: Make sure the fan blades are set at a "V" position to avoid damage to the radiator core.

(7)—On 1940-41 models, disconnect the gearshift rods from the levers at the transmission. (8)—Disconnect the transmission from the flywheel housing and slide the transmission straight back until the main drive gear is out of the clutch disc hub. Use pilot studs when removing or installing the unit to avoid springing the clutch disc. (9)—Lower the unit to the floor.

Assemble in the reverse order, and check the adjustment of the shifter mechanism on 1940-41 cars as described in the GEARSHIFT, ADJUST chapter. See page 11.

NASH & LAFAYETTE

1935-42: NOTE: On the 4140 model, the transmission is removed in the same manner as in 1935-38 except that the rear axle assembly must first be removed. See REAR AXLE ASSEMBLY, REMOVE AND REPLACE.

(1)—On 1935-38 cars, remove the floor boards. NOTE: On 1939-41 cars with steering gearshift, the floor boards need not be removed. (2)—For 1938 cars with vacuum shift, loosen the shift lever fulcrum and disengage the lever from the rods. (3)—For cars with steering gearshift, disconnect the control rods from the levers at the transmission. (4)—If equipped with overdrive, detach the overdrive control cable from the lever at the overdrive case. (5)—Uncouple the speedometer cable. (6)—Disconnect the front and rear universals and remove the propeller shaft assembly. (7)—Unbolt the transmission support. (8)—Remove the bolts which fasten the transmission to the clutch housing and insert pilot studs in the upper holes. (9)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (10)—Lift the assembly out through the driver's compartment, or, if equipped with overdrive, lower the unit onto a suitable dolly.

Replace the unit in the reverse order, being sure to use the pilot studs to guide the assembly safely into position.

OLDSMOBILE

1935-42 SYNCHROMESH: (1)—Take out the floor board on 1935-36 cars, or the transmission floor cover on 1937-41 models. (2)—Detach the speedometer cable. (3)—Remove the propeller shaft assembly. NOTE: On 1937-38 cars, unbolt the intermediate bearing support and remove, or push aside the front propeller shaft.

(4)—On 1939 models, disconnect the shift controls as follows, and to prevent damaging the selector cable, remove the parts in the following sequence: (a)—Disconnect the control rod from the lever at the transmission. (b)—Detach the selector cable from the cable

TRANSMISSION, REMOVE and REPLACE

anchor bracket. (c)—Unscrew the cable from the end of the selector shaft. (d)—Remove the selector shaft lever and helper springs.

(5)—On 1940-41 cars, detach the shift control rods from the levers at the transmission. (6)—On all models, remove the bolts which attach the transmission to the clutch housing and install guide studs in the top holes. (7)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (8)—Remove the assembly by lifting it out through the opening in the floor.

Install the transmission in the reverse order, being sure to use the pilot studs to guide the assembly safely into position. See the GEARSHIFT, ADJUST chapter for service instructions on 1939-42 cars. See page 12.

PACKARD

1935-38 SIXES AND 120'S: (1)—Take out floor boards. (2)—Uncouple the speedometer cable. (3)—Detach the battery cable from the transmission. (4)—Disconnect the propeller shaft at the front. (5)—Remove the clutch housing lower cover. (6)—Disconnect the clutch shifter bearing spring. (7)—Unfasten the engine stabilizer at the rear of the transmission. (8)—Remove the two bolts which fasten the left transmission support to the transmission. (9)—Unfasten the right transmission support from the transmission and the frame and remove the support. (10)—Support the rear of the engine with a jack just enough to eliminate any strain on the front engine mountings. (11)—Remove the bolts which fasten the transmission to the clutch housing and insert pilot studs in the upper holes. (12)—Remove the transmission by sliding it straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (13)—Lift out the assembly.

Replace in the reverse order of removal, being sure to use the pilot studs to guide the assembly safely into position.

1935-38 SUPER EIGHTS AND 1935-39 TWELVES:

(1)—Take out the floor and toe boards. (2)—Disconnect the speedometer cable. (3)—Unfasten the battery cable from the transmission. (4)—Disconnect the foot dimmer switch. (5)—Remove the propeller shaft. (6)—Unbolt the rubber supports from each side of the transmission. (7)—Disconnect the hand brake cable at the equalizer; the rubber-bushed stabilizer link on the left side; the clutch pedal pull rod and pedal spring. (8)—Jack up the rear of the engine just enough to support it without putting any strain on the front engine mountings. (9)—Disconnect the pedal shaft inner bracket and brace rod on the right side of the transmission—at the rear end only. (10)—Remove the lower cross member. (11)—Remove the bolts which fasten the transmission to the clutch housing and insert two pilot studs in two of the mounting holes. (12)—Unbolt the vertical support members from the frame on each side and remove the members. (13)—

Slide the transmission straight back until the main drive gear is out of the clutch disc hub and lower the assembly to the floor.

Replace in the reverse order, being sure to use the pilot studs to prevent the transmission from hanging on the clutch disc.

1939-41 SIXES AND EIGHTS: It is not necessary to remove floor boards. (1)—Disconnect ground wire and speedometer cable. (2)—Dismount the propeller shaft at the front and block it up against the floor pan. (3)—Disconnect the shifter control rods; the hand brake lever cable at the equalizer; the overdrive control cable and rubber bearing at the rear of the overdrive unit (if equipped). (4)—Support the rear of the engine with a jack and unbolt the cross member from the frame. (5)—On the sixes and 120's, remove the lower cover from the flywheel housing and disconnect the clutch retractor spring. (6)—Detach the fore and aft restraint rod. (7)—Remove the bolts which fasten the transmission to the clutch housing and insert pilot studs in the upper holes. (8)—Slide the unit back on the pilot studs until the main drive gear is out of the clutch disc hub and lower the assembly to the floor.

Replace in the reverse order, being sure to use the pilot studs to prevent the weight of the assembly from hanging on the clutch disc. See the GEARSHIFT, ADJUST chapter for service instructions. See page 13.

PIERCE-ARROW

1935-38: (1)—Take out the floor boards. (2)—Uncouple the speedometer cable. (3)—Disconnect the free wheel or overdrive control wire (if equipped). (4)—Remove the propeller shaft assembly. (5)—If equipped with power brake, disconnect the linkage. (6)—Remove the transmission support. (7)—Remove the transmission mounting bolts and insert guide pins in two upper holes. (8)—Slide the assembly straight back on the guide pins until the main drive gear is out of the clutch disc hub, then lower the unit to the floor. Assemble in the reverse order.

PLYMOUTH

1935-39: (1)—Take out the floor boards. (2)—Disconnect the battery cable at the transmission. (3)—Remove the propeller shaft assembly. (4)—Detach the speedometer cable. (5)—Disconnect the hand brake rod on 1935-37 cars, and the hand brake cable on 1938-39 cars. (6)—On 1939 De Luxe cars, detach the gearshift control rod and cable at the transmission. (7)—Take off the transmission cover; and on 1935-38 and P7, 1939 cars, remove the shift lever together with the cover. (8)—On 1935-38 cars, unhook the pull-back spring from the clutch release fork and disconnect the release fork rod. (9)—On 1935-36 cars, remove the release fork pivot screw and pull the fork out of the housing; on 1937-38 cars, remove the clevis pin from the release fork rod and pull the fork out of the housing. (10)—Remove the nuts from the studs

which fasten the transmission to the clutch housing. (11)—Remove the two upper studs and install pilot studs in their place. (12)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (13)—Lower the transmission to the floor.

Assemble in the reverse order, being sure to use the pilot studs to guide the assembly safely into place. See the GEARSHIFT, ADJUST chapter for service instructions on 1939 De Luxe cars. See page 13.

1940-42: NOTE: It is not necessary to remove the floor boards. (1)—Raise the car at the front end and place jacks under the lower control arms. (2)—Disconnect the propeller shaft at the front. (3)—If the transmission is to be disassembled, loosen the companion flange nut. (4)—Uncouple the speedometer cable. (5)—Detach the hand brake cable at the brake band. (6)—Disconnect the gearshift control rods from the transmission. (7)—If equipped with power shift, remove the vacuum and air hose and take off the gearshift selector rod. (8)—Remove the nuts from the studs which fasten the transmission to the clutch housing. (9)—Unscrew the two upper studs and insert guide studs in their place. (10)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub. (11)—Lower the unit to the floor.

Assemble in the reverse order, being sure to use the pilot studs to guide the assembly safely into position. See the GEARSHIFT, ADJUST chapter for service instructions. See page 13.

PONTIAC

1935 EARLY PRODUCTION: NOTE: This transmission is used before Serial Nos. 6AB-23423 on Master 6; 6AA-19858 on De Luxe 6, and 8AA-26175 on the 8's.

(1)—Remove front seat cushions. (2)—Take out the floor and toe boards. (3)—Disconnect the hand brake lever and speedometer cable. (4)—Remove the gearshift lever and transmission cover assembly. (5)—Disconnect the rear engine support from the transmission. (6)—Remove the rear cross member. (7)—Disassemble the universal joint ball and slip the ball housing back on the torque tube. (8)—Split the universal joint and lower the torque tube so that it rests on the frame cross member. (9)—Remove the bolts which fasten the transmission to the clutch housing and insert pilot studs in the upper mounting holes. (10)—Pull the transmission straight back until the main drive gear is out of the clutch disc hub. (11)—Lift the assembly out through the driver's compartment.

Replace in the reverse order.

LATE 1935 AND ALL 1936: NOTE: This unit is used on 1935 cars after the serial numbers listed in the foregoing chapter.

(1)—Since the seat cushion is not removable, it is necessary to take out the front seat as an assembly. (2)—Take out the floor and toe boards. (3)—Disconnect the universal joint. (4)—Remove the rear engine support cross member. (5)—Before removing the rear engine mounting on 6-cylinder cars, support the engine with a jack. (6)—Block up the torque tube until it touches the body cross sill. (7)—Slide the universal joint yoke and ball back as far as possible and place the yoke in a horizontal position. (8)—Disconnect the speedometer cable. (9)—Remove the gearshift lever. (10)—Remove the bolts which fasten the transmission to the clutch housing and insert guide studs in the upper mounting holes. (11)—Pull the assembly straight back until the main drive gear is out of the clutch disc hub and lower the transmission to the floor by passing it below the torque tube.

NOTE: If there is not sufficient clearance for the transmission to pass below the torque tube, additional clearance can be obtained on the 6-cylinder cars by lowering the jack which is supporting the engine. On the 8-cylinder cars, additional clearance can be obtained by removing the screws which attach the body sill to the body main sill, after which, remove the body sill.

Replace the transmission in the reverse order of removal.

1937-38: (1)—Take out the floor mat and floor center panel. (2)—Remove front seat assembly. (3)—Uncouple the speedometer cable. (4)—On 1938 cars with steering gearshift, disconnect the selector control cable from the selector plate hook and from the transmission case, then remove the cable from the case. Detach the outer lever from the transmission cover shift shaft. (5)—Disconnect the rear universal joint. (6)—Unbolt the propeller shaft housing from the transmission. (7)—Unfasten the rear engine support and jack up the engine at the rear to allow the transmission drain plug to clear the frame cross member. (8)—Remove the bolts which fasten the transmission to the clutch housing and insert guide studs in the upper mounting holes. (9)—Pull the transmission backward until the main drive gear is out of the clutch disc hub. Then push it forward and upward at the front to remove the transmission and coupling from the front propeller shaft and housing. (10)—Lift the assembly out through the floor opening.

Replace in the reverse order and see the GEARSHIFT, ADJUST chapter for service instructions on 1938 cars. See page 15.

1939-42: (1)—Take out the floor mat and floor center panel. (2)—Disconnect the speedometer cable. (3)—Detach the gearshift controls from the transmission. (4)—Uncouple the rear universal joint and take out the propeller shaft. (5)—Remove the bolts which fasten the transmission to the clutch housing and insert guide studs in the upper mounting holes. (6)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub, then

TRANSMISSION, REMOVE and REPLACE

push it forward and upward at the front and lift the unit out through the floor opening.

NOTE: On 1939 eights, the transmission cannot be moved back far enough to clear the clutch housing due to interference of the frame X member. Therefore, it is necessary to remove the transmission rear bearing retainer and main shaft assembly, after setting the gears in the high speed position.

Replace the unit in the reverse order and see the GEARSHIFT, ADJUST chapter for service instructions. See page 15.

REO

1935-36 SYNCHROMESH: (1)—Take out the floor mat and floor boards. (2)—Disconnect the hand brake, hand brake bracket and speedometer cable. (3)—Detach the transmission mounting bolts from the frame supports. (4)—Jack up the engine at the rear enough to clear the rubber spools in the transmission mounting. (5)—Disconnect the front and rear universal joints and take out the propeller shaft assembly. (6)—Swing the hand brake lever clear of the transmission. (7)—Remove the transmission supports from the frame. (8)—Lower the engine supporting jack until the brake drum clears the floor of the body. (9)—Remove the bolts which fasten the transmission to the clutch housing and insert guide studs in the upper mounting holes. (10)—Slide the assembly straight back on the guide studs until the main drive gear is out of the clutch disc hub. (11)—Remove the transmission by lowering it at the rear slightly, then lift it out through the floor opening.

STUDEBAKER

1935-40 EXCEPT CHAMPION MODELS: (1)—Take out the floor boards or floor plates. (2)—If necessary, remove the clutch and brake pedal arms. (3)—Disconnect the universal joints—as required—to remove the propeller shaft. (4)—Uncouple the speedometer cable, and, if equipped, the free wheel or overdrive control wire.

(5)—On 1935 Dictator cars, place a jack under the rear of the oil pan to support the engine. Unscrew the bolts holding the support brackets to the rear of the transmission. Then remove the cross member from the frame X member.

(6)—If equipped with overdrive, remove the overdrive support assembly, noting the original arrangement of the support shims, so that installation may be made in the same manner. (7)—On 1939-40 cars with overdrive, disconnect the wires and remove the solenoid unit. (8)—Unfasten the gearshift control rods from the levers at the transmission.

(9)—On all cars, remove the bolts which fasten the transmission to the clutch housing and install pilot studs in the upper mounting holes. (10)—Slide the transmission straight back on the pilot studs until the

main drive gear is out of the clutch disc hub. (11)—Lift the assembly out through the opening in the floor.

NOTE: Installation is made in the reverse order of removal. However, when assembling the overdrive support and the original shim arrangement has been disturbed, or, if new parts are used, proceed as follows: Hold the support firmly in its proper position against the underside of the overdrive housing. Insert sufficient shims to take up all but $\frac{1}{16}$ " clearance between each end of the support and the frame members. Install and tighten the retaining bolts. This $\frac{1}{16}$ " clearance at each end of the support, BEFORE tightening the bolts, provides the proper compression of the support rubber when the bolts are tightened.

1939-40 CHAMPION MODELS: (1)—Disconnect the battery-to-starter cable at the battery. (2)—Raise the car at the rear to provide working clearance under the transmission. (3)—Support the rear of the engine with an adjustable jack, using a wide piece of wood to protect the oil pan. (4)—Remove the floor mat and floor plate. (5)—Remove the two upper bolts which fasten the transmission to the clutch housing and install pilot studs in their place. (6)—Disconnect the speedometer cable and remove the speedometer pinion.

NOTE: To avoid the loss of lubricant, plug the driven pinion hole with rags. (7)—Remove the propeller shaft and universal joints assembly. (8)—Unscrew the transmission support bolts at the transmission and at the frame; then, remove the support and the cushion from the transmission. (9)—Drive out the pins which fasten the gearshift control rods to the levers at the transmission. (10)—Disconnect the exhaust pipe from the bracket at the clutch housing.

(11)—**NOTE:** For cars with overdrive, in addition to the above items, perform the following work: (a)—Drain the cooling system and loosen the hose clamps. (b)—Disconnect the exhaust manifold from the exhaust pipe flange. (c)—Move the oil pressure line out from behind the engine. (d)—Remove the clutch control shaft sleeve pins and disengage the sleeve from the clutch release shaft. (e)—Unfasten the overdrive control and solenoid wires. (f)—Remove the transmission rear flange and, to avoid the loss of lubricant, pack around the shaft with rags. (g)—Lower the engine until the center-line of the mainshaft is $1\frac{3}{4}$ " below the under surface of the frame X member. (h)—Unhook the brake pedal spring.

(12)—On all models, continue by removing the lower transmission-to-clutch housing mounting bolts. (13)—Slide the transmission straight back on the pilot studs until the main drive gear is out of the clutch disc hub, and take out the assembly.

1941 ALL MODELS: (1)—Disconnect the battery cable. (2)—Take out the floor plate over the transmission. (3)—Remove the two upper bolts which fasten the transmission to the clutch housing and insert guide studs in their place. (4)—Raise the rear of the car to provide working clearance under the transmission. (5)

—Support the rear of the engine with an adjustable jack, protecting the oil pan with a wide piece of wood. (6)—Remove the propeller shaft assembly. (7)—On the President, remove the support under the overdrive case. (8)—If equipped, disconnect the overdrive control and solenoid wires. (9)—Remove the speedometer cable and driven pinion. NOTE: To avoid loss of lubricant, plug the driven pinion hole with rags. (10)—Unfasten the gearshift control levers at the transmission. (11)—On the Champion and Commander models only, remove the rear engine support, the clutch operating sleeve pins, the clutch housing to exhaust pipe bracket, and lower the engine. (12)—On all cars, remove the two lower transmission mounting bolts. (13)—Slide the assembly straight back on the guide studs until the main drive gear is out of the clutch disc hub, and take out the assembly.

Reverse the procedure to install and see the GEAR-SHIFT, ADJUST chapter for service instructions. See page 17.

WILLYS

1935-36: (1)—Remove the front seat, cowl trim pads, floor boards and accelerator pedal. (2)—Disconnect the universal joints and remove the propeller shaft. (3)—Raise the engine high enough to remove the rubber mounting rings and the cap screws which attach the mounting bracket to the transmission. NOTE: The upper nuts on the mounting bolts control the tension of the upper rebound rubber rings and should not be disturbed. (4)—Remove the bolts which attach the clutch housing to the engine and insert pilot

studs in two upper holes. (5)—Pull the transmission back until the main drive gear is out of the clutch disc hub.

1937-41: (1)—Remove the mat and floor board. (2)—On cars with floor-type gearshift, unscrew the retaining collar at the bottom of the lever and take out the lever. (3)—On cars with steering gearshift, disconnect the control rods from the levers at the transmission. (4)—Loosen the radiator-to-body brace rod. (5)—Unfasten—but do not remove entirely—the radiator hold-down nuts. (6)—Disconnect the propeller shaft at the front end. (7)—Uncouple the speedometer cable. (8)—Take off the LOWER nuts from the rear mounting bolts at the rear of the transmission. (9)—Jack up the rear of the engine—using a wide piece of wood to protect the oil pan—until the mounting bracket at the rear of the transmission can be removed. Continue jacking up the engine until the transmission clears the cross member. (10)—Remove the bolts which fasten the transmission to the clutch housing and insert pilot studs in the upper holes. Reach through the hand hole cover and unhook the clutch release bearing pull-back spring. (11)—Slide the transmission straight back on the guide studs until the main drive gear is out of the clutch disc hub, then, lift the assembly out through the opening in the floor.

NOTE: The transmission is installed in the reverse order of removal. However, after tightening the LOWER nuts of the mounting bolts, see that the upper snubbing rubber is expanded about $\frac{1}{8}$ ". This can be accomplished by tightening the UPPER nuts.

TRANSMISSION, OVERHAUL

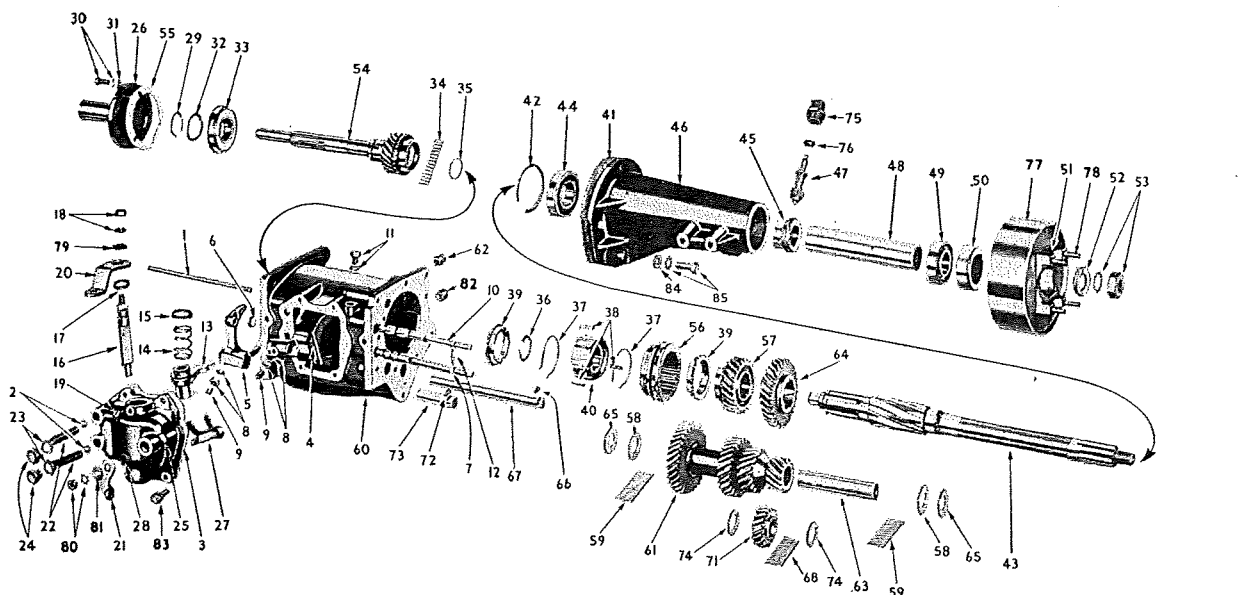


Fig. 40—Group No. 1 Transmission Without Overdrive

- | | | | |
|--------------------------------|------------------------------------|---------------------------------|-----------------------------------|
| 1—Shift fork guide rail | 23—Selector ball spring washer | 45—Speedometer drive gear | 67—Countershaft |
| 2—Shift selector balls | 24—Selector ball spring screw | 46—Extension housing | 68—Bearing rollers—reverse idler |
| 3—Shift housing gasket | 25—Gearshift housing | 47—Speedometer drive pinion | 69—Extension screw grommet |
| 4—Low and reverse shift fork | 26—Bearing retainer | 48—Mainshaft bearing spacer | 70—Extension screw and washer |
| 5—Second and high shift fork | 27—Shift selector cam and shaft | 49—Extension housing bearing | 71—Reverse idler gear |
| 6—Shift rail plug | 28—Selector cam shaft oil seal | 50—Rear bearing oil seal | 72—Reverse idler shaft key |
| 7—Second and high shift rail | 29—Bearing snap ring | 51—Mainshaft flange | 73—Reverse idler shaft |
| 8—Lock screw nut and washer | 30—Retainer screw and washer | 52—Flange washer | 74—Reverse idler gear washer |
| 9—Shift fork lock screw | 31—Retainer screw grommet | 53—Flange nut and washer | 75—Speedometer pinion sleeve |
| 10—Low and reverse shift rail | 32—Bearing washer | 54—Main drive gear | 76—Speedometer pinion oil seal |
| 11—Interlock screw and washer | 33—Main drive gear bearing | 55—Bearing retainer gasket | 77—Transmission brake drum |
| 12—Shift rail interlock | 34—Mainshaft pilot bearing rollers | 56—Synchronizer clutch sleeve | 78—Universal joint bolt |
| 13—Shift lever | 35—Pilot bearing snap ring | 57—Second gear | 79—Operating lever nut washer |
| 14—Shift lever kickover spring | 36—Clutch gear snap ring | 58—Thrust plate | 80—Selector lever nut and washer |
| 15—Shift lever spring washer | 37—Synchronizer spring | 59—Countershaft bearing rollers | 81—Selector lever washer |
| 16—Shift lever shaft | 38—Synchronizer shifting plate | 60—Transmission case | 82—Filler plug |
| 17—Shift housing seal | 39—Synchronizer stop ring | 61—Cluster gear | 83—Shift housing screw and washer |
| 18—Shift operating lever nut | 40—Synchronizer clutch gear | 62—Drain plug | 84—Extension screw grommet |
| 19—Shift lever shaft screw | 41—Extension housing gasket | 63—Countershaft bearing spacer | 85—Extension screw and washer |
| 20—Shift operating lever | 42—Rear bearing snap ring | 64—Low and reverse gear | |
| 21—Shift selector lever | 43—Mainshaft | 65—Thrust washer | |
| 22—Shift selector ball spring | 44—Mainshaft rear bearing | 66—Countershaft key | |

GROUP No. 1

Figs. 40, 41

CHRYSLER, DE SOTO, DODGE, PLYMOUTH 1940-42 ALL WITHOUT OVERDRIVE

SHIFTER MECHANISM: (1) — Remove the power-shift assembly (if equipped) after disconnecting the gearshift link from the selector lever. (2) — Remove speedometer drive pinion. (3) — Take out the two screws which retain the springs and balls for the shift rails and lift off the transmission cover and gear selector assembly. (4) — Remove nut and washers from the rear end of the mainshaft and pull off the transmission brake drum and universal flange assembly.

NOTE—Use a puller for this operation to avoid damaging the synchronizer. (5) — Unscrew the shift fork guide rail from the front of the case. (6) — Place gears in neutral and take out the two lock screws which fasten the shift forks to the shift rails. (7) — Drive out lower shift rail plug and slide both rails out

through the front of the case. **NOTE**—When assembling the transmission, install a new welch plug and, as this plug is below the lubricant level, be sure it does not leak. (8) — Lift out the shift forks, using care not to drop the detent balls down into the case. (9) — Unscrew the bolts which fasten the extension housing to the transmission. (10) — Withdraw the extension housing, together with the mainshaft assembly to the rear, using care not to allow the synchronizer to come apart.

NOTE—A shift rail selector plug is located in the vertical drilled hole on top at the rear of the transmission, and is sealed by a cupped plug. Drive the cupped plug down into the hole and remove the selector plug.

CAUTION—When installing the shift rails, the detent grooves are farther apart on the first and reverse rail so make sure that this rail is installed on top. Replace the shift rail selector plug in the vertical drilled hole in the rear of the transmission case—between the rails. This hole is plugged by a cap screw on 1940 units, and by a cupped plug on 1941-42 cars.

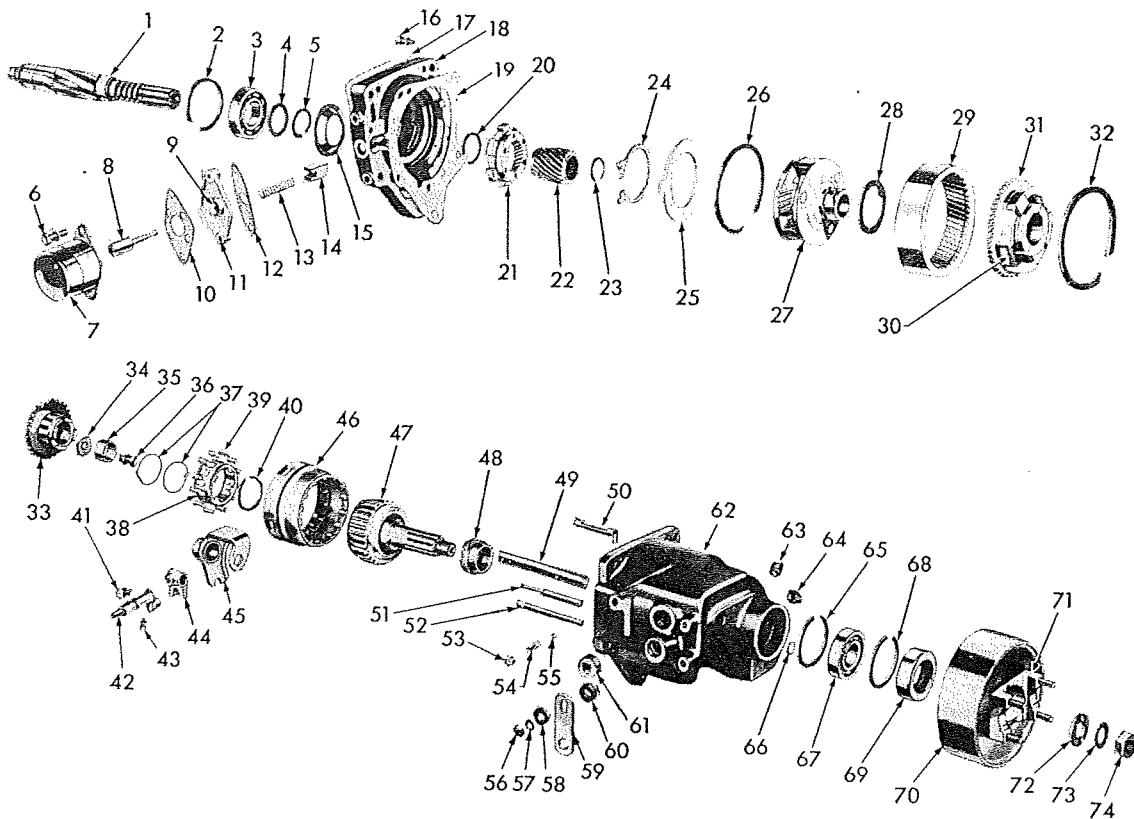


Fig. 41—Group No. 1 Overdrive

- | | | | |
|-----------------------------|--------------------------------|---------------------------------|--------------------------------|
| 1—Transmission mainshaft | 20—Sun gear snap ring | 39—Free wheel roller | 58—Control shaft washer |
| 2—Rear bearing snap ring | 21—Sun gear plate | 40—Cam retainer snap ring | 59—Control lever |
| 3—Mainshaft rear bearing | 22—Overdrive sun gear | 41—Shift rail lug set screw | 60—Control shaft oil seal |
| 4—Rear bearing washer | 23—Pinion cage snap ring | 42—Overdrive control shaft | 61—Housing plug |
| 5—Rear bearing snap ring | 24—Sun gear balk ring | 43—Control shaft locating screw | 62—Overdrive housing |
| 6—Solenoid mounting screw | 25—Sun gear cover plate | 44—Control shift rail lug | 63—Filler plug |
| 7—Solenoid | 26—Sun gear plate snap ring | 45—Control shift fork | 64—Drain plug |
| 8—Solenoid core | 27—Planet pinion cage | 46—Clutch pawl shell | 65—Bearing snap ring, front |
| 9—Solenoid base seal | 28—Clutch core thrust washer | 47—Overdrive mainshaft | 66—Shift rail expansion plug |
| 10—Solenoid gasket | 29—Overdrive ring gear | 48—Speedometer drive gear | 67—Overdrive mainshaft bearing |
| 11—Solenoid base and seal | 30—Clutch pawl adjusting screw | 49—Control shift rail | 68—Bearing snap ring, rear |
| 12—Solenoid base gasket | 31—Overdrive clutch core | 50—Transmission case oil trough | 69—Rear bearing oil seal |
| 13—Solenoid core spring | 32—Ring gear snap ring | 51—Reverse lockup plunger | 70—Brake drum |
| 14—Sun gear pawl | 33—Free wheel cam | 52—Shift fork guide pin | 71—Flange |
| 15—Mainshaft oil baffle | 34—Free wheel cam washer | 53—Poppet spring seat | 72—Flange nut washer |
| 16—Adapter screw and washer | 35—Mainshaft pilot bushing | 54—Poppet ball spring | 73—Lockwasher |
| 17—Adapter gasket | 36—Cam screw and washer | 55—Poppet ball | 74—Flange nut |
| 18—Adapter | 37—Free wheel roller springs | 56—Control shaft nut | |
| 19—Housing gasket | 38—Free wheel roller retainer | 57—Control shaft nut washer | |

When installing the cover, place the shift rails in neutral and insert two pilot studs in two diagonally-opposite cap-screw holes in the cover, being sure that the gearshift selector lever enters the shift fork slots. Then install two cover cap screws, remove the two pilot studs, and replace the other cap screws.

MAINSHAFT: (11)—To disassemble the mainshaft, remove the synchronizer retaining snap ring and slide the synchronizer unit, second speed gear and low and reverse gear from the shaft. (12)—Take off the transmission rear bearing snap ring and remove the mainshaft from the extension housing. (13)—The mainshaft rear bearing, the spacer and speedometer drive gear is then removed from the shaft. (14)—Press the extension housing bearing and oil seal from the housing.

NOTE—When installing a new oil seal in the extension housing, it should be thoroughly soaked in oil and the leather worked with a steel roller until it is soft and pliable. When installed, the oil seal should protrude $7/32$ " out of the case, which will prevent damage to the bearing and also to the seal itself.

When installing the second speed gear, check its end play by inserting a feeler gauge between the back face of the gear and the butt end of a spline on the mainshaft. End play should be from .003" to .008" and if not within these limits, thrust washers of several thicknesses are available to obtain this clearance.

SYNCHRONIZER: **NOTE**—Before dismantling the synchronizer unit, be sure that the relationship of the synchronizer rings and the clutch sleeve is

TRANSMISSION, OVERHAUL

marked so that installation may be made in the original position.

(15)—Remove the synchronizer rings from the assembly. (16)—Unhook the synchronizer springs from the shifting plates. (17)—Slide the clutch sleeve from the clutch gear.

NOTE—Reverse the above procedure to assemble, and when replacing the synchronizer springs, one of the turned out ends of each spring should be inserted in opposite ends of the same shifting plate. Then install the stop rings so the slots engage the shifting plates.

MAIN DRIVE GEAR: **NOTE**—Before this assembly can be removed, the countershaft must be driven out, allowing the countergear cluster to lie in the bottom of the case. See the **COUNTERSHAFT** paragraph.

(18)—Take off the main drive gear bearing retainer and, after removing the snap ring, pull the main drive gear assembly out through the front.

NOTE—Before installing the gear, be sure to place the countergear assembly in the bottom of the case, but **DO NOT** install the countershaft until after the main drive gear is in position.

COUNTERSHAFT: (19)—Use a dummy arbor (Fig. 49) to hold the needle bearings in place and drive the shaft out rearward, allowing the countergear assembly to lie in the bottom of the case until the main drive gear is removed—as already explained.

NOTE—To install the assembly: (a)—Insert the bearing spacer into the gear and then, insert the dummy shaft (or arbor) which was used when removing the assembly. (b)—Apply a liberal amount of cup grease at each end of the gear and insert the needle bearings. (c)—After the needle bearings are properly inserted, place a steel thrust plate at each end of the gear, and a bronze thrust washer at each end of the assembly, using cup grease to hold them in position. (d)—Place the entire assembly into the case and, before installing the regular countershaft, replace the main drive gear assembly. (e)—Position the countergear assembly and drive the dummy shaft out by installing the regular countershaft through the rear.

NOTE—The end play of the countershaft gears should be from .002" to .008" and can be checked by forcing the assembly toward the front. Then insert a feeler gauge between the thrust washer and the case at the rear. Thrust washers are available in several thicknesses to obtain this clearance.

REVERSE IDLER: Lift the reverse idler out of the case after driving the shaft out through the rear.

ASSEMBLE: Reverse the order of removal to assemble the transmission. To insure a proper fit in their grooves, snap rings which have been removed should be replaced with new ones.

TRANSMISSION AND OVERDRIVE, OVERHAUL

NOTE—If repairs are to be made on the transmission only, the overdrive need not be disassembled ex-

cept if the transmission mainshaft is to be replaced. However, since the adapter plate is fastened to the overdrive case by three screws at its front side, it is necessary to remove the mainshaft assembly, together with the overdrive and adapter plate, in order to remove the controls from the overdrive housing.

(1)—Remove the gearshift mechanism as described for cars without overdrive. (2)—Lock the transmission in two gears and take off the overdrive mainshaft flange nut and washers. (3)—Pull off the transmission brake drum and flange assembly. (4)—Disconnect the overdrive case from the transmission case. (5)—Withdraw the overdrive assembly, together with the adapter plate and transmission mainshaft assembly rearward. (6)—Remove the synchronizer retaining snap ring and slide the synchronizer unit, second speed gear and low and reverse gear from the mainshaft.

NOTE—If further repairs are needed on the transmission, proceed in exactly the same manner as described for cars without overdrive. However, end play of the countershaft should be from .002" to .011" for overdrive-equipped cars.

OVERDRIVE, DISASSEMBLE: (1)—After removing the synchronizer assembly and gears from the mainshaft, take out the three screws which fasten the adapter plate to the overdrive case. (2)—Remove the overdrive case and clutch pawl shell assembly. **NOTE**—It may be necessary to tap the end of the overdrive mainshaft to prevent the internal parts from coming away with the case. (3)—Slip off the speedometer drive gear. (4)—Pull the overdrive mainshaft from the free wheel unit, catching the rollers as they fall. (5)—Remove the cap screw and bushing from the end of the transmission mainshaft and pull the free wheel cam and roller cage assembly from the shaft. (6)—Unscrew the bolts which fasten the solenoid to the adapter plate and lift out the solenoid and plunger. (7)—Take off the snap ring which retains the planet pinion cage to the transmission mainshaft. (8)—Remove the snap ring which retains the sun gear plate and lift off the loose parts. (9)—Release the snap ring which retains the mainshaft rear bearing in the adapter plate and press the bearing off the mainshaft.

OVERDRIVE CASE: **NOTE**—If necessary to remove the clutch pawl shell or the overdrive control parts, proceed as follows: (1)—Pull the overdrive reverse lock-up plunger and shift fork guide pin out through the front of the case. (2)—Remove the nut and washers from the shaft on the left side of the case and pull off the control shaft lever. (3)—Detach the shift rail poppet ball spring seat, inspection plug and the shifter rail locating set screw. (4)—Drive the overdrive shift rail out through the rear of the case, pushing the expansion plug out at the same time. (5)—Lift out the shift lug, control fork and spring and slide the overdrive clutch pawl shell out of the case. (6)—If necessary, the control shaft may then be removed by pushing it into the case. (7)—Use a puller to pull the oil seal from the rear of the case. (8)—Release the snap rings at both sides of the bearing and push the

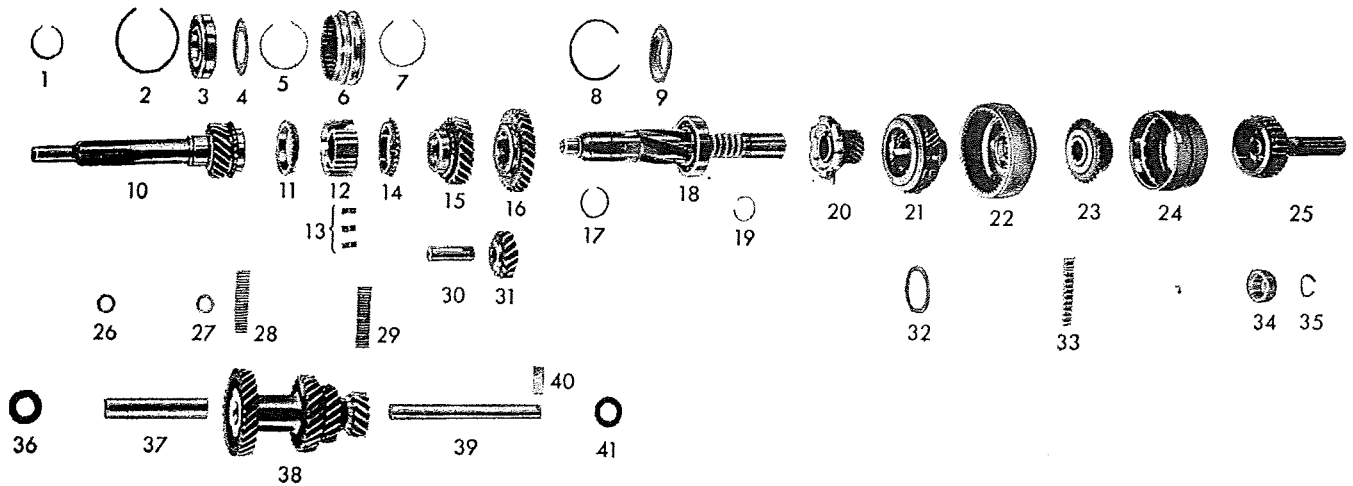


Fig. 42—Group No. 2 Transmission and Overdrive on Studebaker Champion

1—Snap ring, small
2—Snap ring, large
3—Bearing
4—Oil baffle
5—Synchronizer spring
6—Synchronizer clutch sleeve
7—Synchronizer spring
8—Snap ring
9—Oil baffle
10—Main drive gear
11—Stop ring

12—Synchronizer clutch gear
13—Shifting plates
14—Stop ring
15—Second gear
16—Low and reverse gear
17—Snap ring
18—Mainshaft
19—Snap ring
20—Sun gear and plate
21—Planet pinion cage
22—Ring gear

23—Free wheel cam
24—Clutch pawl shell
25—Overdrive mainshaft
26—Bearing retainer
27—Bearing retainer
28—Roller bearings
29—Roller bearings
30—Reverse idler shaft
31—Reverse idler gear
32—Thrust washer
33—Free wheel rollers

34—Speedometer drive gear
35—Snap ring
36—Thrust washer
37—Bearing spacer
38—Cluster gear
39—Countershaft
40—Lock plate
41—Thrust washer

bearing into the case. NOTE—When replacing, install the front snap ring, press the bearing in from the rear and then, install the rear snap ring.

FREE WHEEL CAM & ROLLERS: (1)—Remove the retaining snap ring from the free wheel cam. (2)—Pull the retainer partly off the hub and unfasten the end of one spring out of the cam hub. (3)—Pull the retainer further off the hub and detach the end of the second spring from the cam hub.

NOTE—When assembling, use a rubber band to hold the free wheel rollers in position in the retainer and install the shaft with the free wheel outer shell over the free wheel cage and rollers.

OVERDRIVE RING GEAR & CLUTCH: (1)—Remove the snap ring from the rear of the ring gear. (2)—Lift out the overdrive clutch assembly. (3)—Take out the clutch pawl adjusting screws. NOTE—When removing these screws, it is important to count the number of half turns so that when they are replaced, the original cut-in speed of the overdrive is retained. Each half turn of the screw is indicated by a click.

Due to the elaborate fitting methods required, the bushing in the center of the overdrive clutch core should not be replaced. If worn, it will be necessary to replace the clutch assembly.

SOLENOID PLUNGER & PAWL: Since the oil seal is pressed into the plunger housing and staked in position, it should not be removed. NOTE—The clearance between the solenoid pawl and balk ring should be .015" with the pawl in its extreme outward position.

This clearance can be obtained by adding gaskets under the solenoid unit.

SUN GEAR & BALK RING: To remove the sun gear plate, take the snap ring from the sun gear and slide off the plate. NOTE—When assembling, be sure that the oil slots in the plate line up with the oil slots in the gear.

GROUP No. 2 Figs. 42, 43

NASH 1941-42 SERIES 40

STUDEBAKER 1939-42

ALL EXCEPT 1939 COMMANDER
WITH FLOOR SHIFT BUT NO OVERDRIVE
WILLYS DELUXE 1940 AND ALL 1941-42

NOTE—For service instructions on 1939 Studebaker Commander with floor shift and with no overdrive, See Group No. 29.

WITHOUT OVERDRIVE

CAUTION—If repairs are to be made on the transmission ONLY, they can be accomplished without disassembling the overdrive—except if the transmission mainshaft is to be replaced. Similarly, it is not necessary to dismantle the transmission if the overdrive ONLY is to be serviced unless the sun gear or adapter plate is to be replaced.

To disassemble the transmission on Studebaker Commander and President cars equipped with the standard floor type shift mechanism: (1)—Unscrew the shift lever cap and remove the lever. (2)—Take off the transmission side cover and shift rails, using care not

TRANSMISSION, OVERHAUL

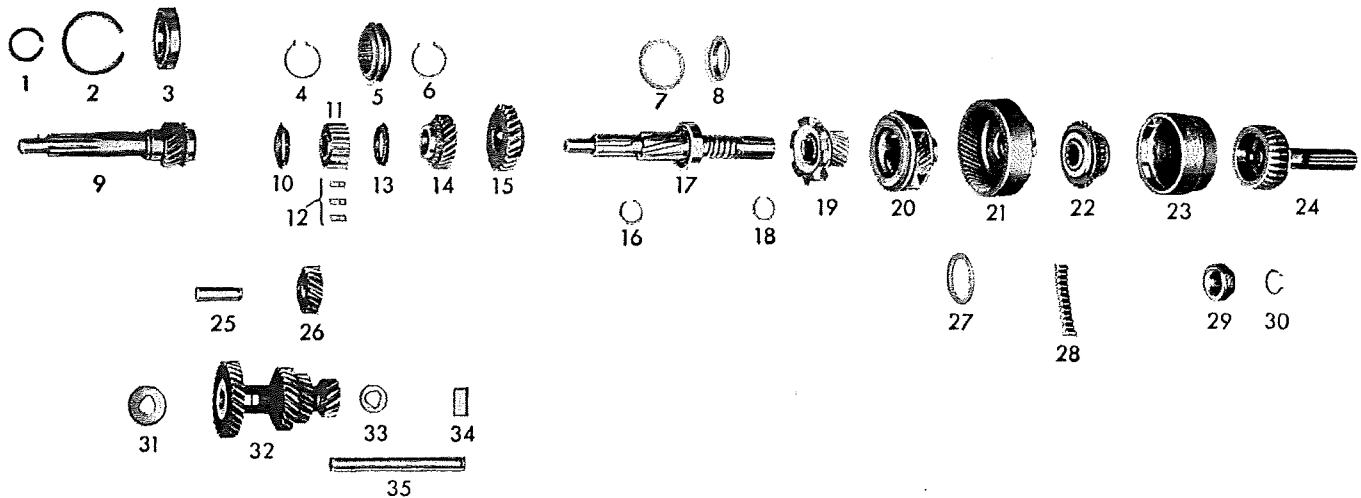


Fig 43—Group No. 2 Transmission and Overdrive on Studebaker Commander and President

- 1—Snap ring, small
- 2—Snap ring, large
- 3—Bearing
- 4—Synchronizer spring
- 5—Synchronizer clutch sleeve
- 6—Synchronizer spring
- 7—Snap ring
- 8—Oil baffle
- 9—Main drive gear

- 10—Stop ring
- 11—Synchronizer clutch gear
- 12—Shifting plates
- 13—Stop ring
- 14—Second gear
- 15—Low and reverse gear
- 16—Snap ring
- 17—Mainshaft
- 18—Snap ring

- 19—Sun gear and plate
- 20—Planet pinion cage
- 21—Ring gear
- 22—Free wheel cam
- 23—Clutch pawl shell
- 24—Overdrive mainshaft
- 25—Reverse idler shaft
- 26—Reverse idler gear
- 27—Thrust washer

- 28—Free wheel rollers
- 29—Speedometer drive gear
- 30—Snap ring
- 31—Thrust washer
- 32—Cluster gear
- 33—Thrust washer
- 34—Lock plate
- 35—Countershaft

to lose the interlock plungers and springs. (3)—Remove the solenoid. (4)—Remove the speedometer pinion and disconnect the overdrive housing from the transmission.

NOTE—The balance of the work is performed in exactly the same manner as the 1940 Commander and President cars.

For cars with steering gearshift, proceed as follows:

MAIN DRIVE GEAR: (1)—After removing the transmission cover, unbolt the main drive gear bearing retainer and slide it forward off the shaft. (2)—Remove the large and small snap rings which retain the main drive gear bearing in front of the case, after which, pull out the bearing. **NOTE**—A bearing puller should be used for this operation and to avoid damaging the synchronizer, a thrust yoke or other suitable device should be placed between the main drive gear and the second speed gear to absorb the thrust as the bearing is being removed. For the same reason, this tool should be used when the bearing is being installed. In addition, however, use a section of pipe to drive the bearing into position, being sure that the pipe thrusts against the inner race of the bearing.

(3)—The main drive gear can be withdrawn through the front of the case after first removing the mainshaft rear bearing retainer.

MAINSHAFT: **NOTE** — Before removing the mainshaft, mark the relationship of the synchronizer sleeve with the rings so that, if disassembled, installation may be in the original position.

(4)—Remove the speedometer pinion. (5)—Unbolt the mainshaft rear bearing retainer housing and slide the housing from the rear of the shaft. (6)—Drive out

the shift shaft lock pins and pull the shift levers away from the case as far as possible. (7)—Withdraw the main drive gear out through the front of the case. (8)—Pull the mainshaft over as far as possible to disengage the shift forks. (9)—Use suitable spreader pliers to release the snap ring from the front of the mainshaft. (10)—Grasp the mainshaft gears and synchronizer assembly and withdraw the mainshaft through the gears and out of the case through the rear.

SYNCHRONIZER: **NOTE** — Before dismantling the synchronizer unit, be sure that the relationship of the synchronizer rings and the clutch sleeve is marked (as already mentioned) so that installation may be made in the original position.

(11)—On Nash, Studebaker Champions and Willys cars, take the synchronizer rings from the assembly and slide the clutch sleeve from the clutch gear, being careful not to lose the shifting plates. (12)—Remove the snap rings from the clutch gear.

(13)—To assemble, place the shifting plates in position in the clutch gear cutouts and install this assembly into the clutch sleeve. (14)—Replace the snap rings, being sure that the shifting plates are in their proper position.

(15)—On the Studebaker Commander and President units, remove the synchronizer rings from the assembly. (16)—Unhook the synchronizer spreader springs from the shifting plates. (17)—Slide the clutch sleeve from the clutch gear.

NOTE—Reverse the above procedure to assemble, and when replacing the spreader springs, one of the turned out ends of each spring should be inserted in opposite ends of the same shifting plate. Then install the stop rings so the slots engage the shifting plates.

COUNTERSHAFT: (18) — Remove the countershaft lock and drive the shaft out through the rear of the case. NOTE—Studebaker Commander and President units are equipped with needle bearings, therefore, in order to hold them in position, a dummy shaft—or arbor—should be used to drive out the regular countershaft. Since Nash, Studebaker Champions and Willys units use countershaft bushings, an ordinary drift can be used to drive out the shaft.

NOTE—When replacing the countergear assembly on units with bushings, install the plain thrust washer at the front end of the gear and the tongued washer at the rear, being sure that the tongues are toward the case. On units with needle bearings, place a ring washer at each end of the countergear and a tongued washer next to the case at both ends—with the tongues toward the case.

REVERSE IDLER: The gear may be lifted out of the case after driving the reverse idler shaft out toward the rear of the case.

ASSEMBLE: Reverse the general order of procedure to assemble the unit, and when replacing the shifter mechanism, be sure to set it in neutral. When the transmission is installed in the chassis, adjust the shift control rods as described in the STEERING GEARSHIFT chapter.

WITH OVERDRIVE

NOTE—This unit, with the exception of the mainshaft, is constructed exactly the same as the one without overdrive. If work is to be done on the transmission ONLY, it can be accomplished without disassembling the overdrive—except if the mainshaft is to be replaced.

(1)—Remove the transmission cover, main drive gear bearing retainer and the main drive gear bearing as described for this unit without overdrive. (2)—Drive the lock pins out of the shift shafts and pull the levers away from the transmission case as far as possible. (3)—Mark the relationship of the synchronizer rings with the clutch sleeve so that installation may be made in the original position. NOTE—Be sure to align these marks when reassembling. (4)—Remove the speedometer pinion. (5)—Unbolt the overdrive case from the transmission case. (6)—Hold the main drive gear shaft with one hand and the over-drive assembly with the other, then tilt the two units so as to withdraw the main drive gear through the front of the case. (7)—Grasp the mainshaft gears and synchronizer assembly and pull the overdrive assembly rearward; the mainshaft will come away with the overdrive.

NOTE—The balance of the work is performed in the same manner as described for units without overdrive. If the mainshaft is to be replaced, see the OVERDRIVE, OVERHAUL chapter for service instructions.

OVERDRIVE, OVERHAUL: NOTE — If repairs are to be made on the overdrive ONLY, it is not necessary to dismantle the transmission unless the sun gear or adapter plate is to be replaced.

(1)—Take off the overdrive rear bearing retainer. (2)—Use suitable spreader pliers to release the snap ring which retains the rear bearing. (3)—Remove the speedometer pinion. (4)—Unbolt the overdrive case from the transmission case and slide the overdrive case rearward. NOTE—It may be necessary to tap the end of the overdrive shaft lightly to prevent the internal parts from coming away with the case.

(5)—Hold one hand under the free wheel roller retainer to catch the rollers as the overdrive tail shaft is pulled rearward. (6)—The free wheel retainer and hub bushing can now be slipped off after first removing the retainer cap screw. (7)—Disengage the ring gear and clutch assembly from the pinions. NOTE—If necessary to remove the clutch from the ring gear, mark the relationship of these parts so that installation may be made in the original position; then remove the snap ring which holds these parts together.

(8)—Slide off the pinion cage thrust washer and remove the pinion assembly from the shaft. (9)—Take off the adapter plate snap ring and thrust plate. (10)—Detach the solenoid from the adapter plate and remove the solenoid pawl and plunger. (11)—Release the snap ring which retains the sun gear, after which, the sun gear and blocker assembly can be removed from the shaft.

NOTE—At this point, if repairs are to be done to the transmission, see the TRANSMISSION, OVERHAUL chapter for instructions. And, if it is necessary to remove the overdrive control parts from the overdrive case, proceed as follows, paying particular attention to the arrangement of the parts.

(12)—Loosen the lock screw and take out the overdrive shift control lever, after which, the overdrive shift control lever and shaft may be removed. (13)—To remove the overdrive shift yoke, back out the lock screws, remove the plug, and loosen the retaining screw which will permit the removal of the shift shaft, fork and spring.

ASSEMBLE: Reverse the general order of procedure to assemble the unit, paying particular attention to the following remarks.

If the clutch pawl adjusting screws have been removed, they should be installed so that each screw receives the same number of turns to provide equal tension on the springs. As these springs control the cut-in speed of the overdrive, both pawls should engage at the same time. Therefore, the screws should be turned in until the top of the screw heads are exactly 1/16 inch below the top edge of the counterbore. The tighter these screws are turned, the higher will be the cut-in speed.

Wear on the pawl raceway or windows of the clutch sleeve produces a rasping noise at speeds above 30 MPH—which vanishes when the overdrive is engaged. A worn sleeve should be replaced, and when this is done, the clutch unit should also be installed.

The clearance between the solenoid pawl and the balk ring should be .015" with the solenoid in place

TRANSMISSION, OVERHAUL

and energized. Adjust the clearance by adding gaskets under the solenoid unit.

When installing the free wheel rollers, use a rubber band to hold them in position. Install the free wheel cam hub bushing and tongued washer—with the tongue toward the cam—and replace the retaining cap screw securely.

If the reverse plunger has been removed, be sure to install it in the overdrive housing with the long portion of its small diameter to the front.

GROUP No. 3

Fig. 44

CHRYSLER 1936, C7, C8. DE SOTO 1936 ALL GRAHAM 1936 AND EARLY 1937

NASH-LAFAYETTE 1936, 3610, 3640, 3710

NASH 3720

STUDEBAKER DICTATOR 1936 AND EARLY DICTATOR 1937

NOTE—Although the internal parts of the transmission and overdrive are contained in a single housing, service on the transmission is exactly the same as described for these cars without overdrive. Therefore, only the overdrive procedure will be described. See Group No. 5 for Chrysler and De Soto. For Graham and Studebaker cars, see Group No. 32. In the case of Nash, match the transmission being serviced with the illustrations in Groups No. 28 and 29 and be guided accordingly.

(1)—Pull the overdrive companion flange from the mainshaft. (2)—Take out the cap screws which fasten the rear bearing retainer to the case.

(3)—Remove the speedometer pinion. (4)—Take off the rear bearing retainer, together with the speedometer drive gear from the end of the mainshaft. NOTE—To pull the retainer back, use two 5/16" cap screws, turning them into the threaded holes in the rim of the retainer.

(5)—Unscrew the overdrive internal gear nuts and pull the overdrive shaft from the internal gear. (6)—Unfasten the free wheel cam retaining nut and take out the cam and rollers. (7)—Remove the oil baffle and then the internal gear assembly. (8)—Unbolt the cap screws from the adapter plate and remove the sun gear and adapter plate.

(9)—Remove the overdrive control lever from the side of the case. (10)—Unbolt the control shaft lock screw and move the shaft in as far as possible to disengage the notch in the overdrive control rail. (11)—Move the sleeve forward and take out the horse shoe lock from the rear of the rail. (12)—Drive the rail forward to disengage it from the fork and remove the rail from the case, driving the welch plug out with the rail. (13)—Take out the shift fork through the top and pull the overdrive clutch sleeve from the shaft to the rear.

NOTE—At this point, if repairs are to be made to the transmission, follow the instructions as described

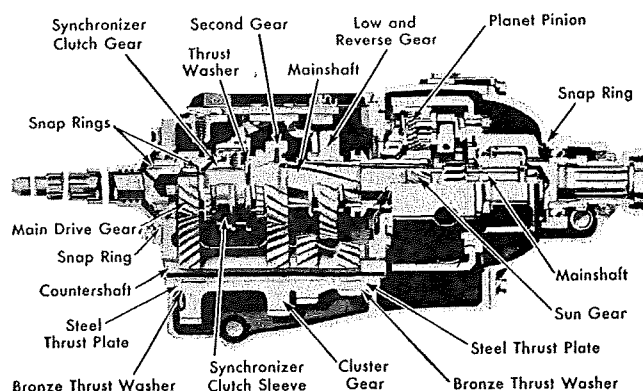


Fig. 44—Group No. 3 Overdrive Transmission

for these cars WITHOUT OVERDRIVE. See the note at the beginning of this chapter.

CAUTION—If the overdrive clutch is to be disassembled, note the position of the adjusting screws and count the number of turns required for their removal so that installation may be made in the same position, thus maintaining the original cut-in speed.

(14)—Release the ring gear pilot bearing snap ring and place the assembly on the bench with the bolts down. (15)—Tap the rim of the unit to remove the pilot bearing race and then take off the pinion and cage assembly.

ASSEMBLE: When installing the pinions to the sun gear, place the pinion cage assembly in the ring gear. Then remove the sun gear and install it separately at the rear of the transmission case, after first slipping the clutch sleeve on the mainshaft. Use a rubber band to hold the free wheel rollers in position in the retainer. Install the tail shaft with the free wheel outer shell over the free wheel cage and rollers.

NOTE—To align the rollers with the flats of the cam, it may be necessary to hold the roller cage against its spring tension while installing the tail shaft. Replace the free wheel cam retaining nut and tighten it securely against the lock and spacer.

GROUP No. 4

Fig. 45

CHRYSLER 8, 1935-39, C1, C2, C3, C10,

C11, C15, C17, C19, C20, C23, C24

DE SOTO 1935, SG. HUPMOBILE 1935-36, 521-O, 527T, 621-O, 621N

STUDEBAKER PRESIDENT 1936

NOTE—If repairs are to be made on the transmission only, they can be accomplished without disassembling the overdrive. Similarly, it is not necessary to dismantle the transmission if only the overdrive requires service. To disconnect the two units, remove the bolts which fasten the overdrive housing to the transmission case and pull off the overdrive assembly. Service on the overdrive is described further on in this chapter.

TRANSMISSION, OVERHAUL

SHIFT MECHANISM: (1)—Remove the transmission cover screws and lift off the cover and shift lever assembly. **NOTE**—The shift rails and forks are contained in the cover and if necessary to disassemble, loosen the shift fork lock screws and drive the shift rails out of the cover and forks.

COUNTERSHAFT: **NOTE**—Before the main drive gear or the mainshaft assembly can be removed, the countershaft must be driven out and the countergear cluster allowed to remain in the bottom of the case. Similarly, before installing these assemblies, place the countergear in the bottom of the case, but do not install the shaft until after these assemblies are replaced.

(2)—Remove the locking pin and drive the countershaft out rearward, using a dummy shaft or arbor of the right length to hold the thrust washers in place.

NOTE—To install the countergear assembly, insert the bearing spacer and bearings into the gear. Install the dummy shaft or arbor which was used to remove the countershaft, place one of the bronze washers on the front of the countergear and the other bronze washer and steel washer on the rear of the assembly, with the steel washer next to the gear—using cup grease to hold them in position. Install the entire assembly into the case, but **DO NOT** install the countershaft until the main drive gear and mainshaft assemblies are replaced. Then, align the countergear cluster and thrust washers with the holes in the case and drive the countershaft in from the rear.

MAIN DRIVE GEAR: (3)—Remove the retainer screws and pull the front bearing retainer from the main drive gear shaft. (4)—Drive the main drive gear and bearing out through the front, using a soft metal drift against the gear.

NOTE—When replacing, install the mainshaft front pilot bearing into the pocket of the main drive gear and tap the gear and its bearing in through the front of the case, using care to guide the pilot bearing over the end of the mainshaft.

MAINSHAFT: (5)—Tap the mainshaft assembly back until the rear bearing is clear of the case. **NOTE**—Before disassembling the mainshaft, mark the relationship of the synchronizer clutch sleeve with the clutch gear so that, if disassembled, assembly may be made in the same relative position.

(6)—To disassemble the mainshaft: (a)—Slip the synchronizer from the mainshaft. (b)—Remove the second speed gear by using a suitable pointed tool through a hole in the second speed gear thrust washer and depress the spring plunger. (c)—Turn the washer until its splines align with the grooves on the mainshaft, after which, the washer and gears can be removed from the shaft.

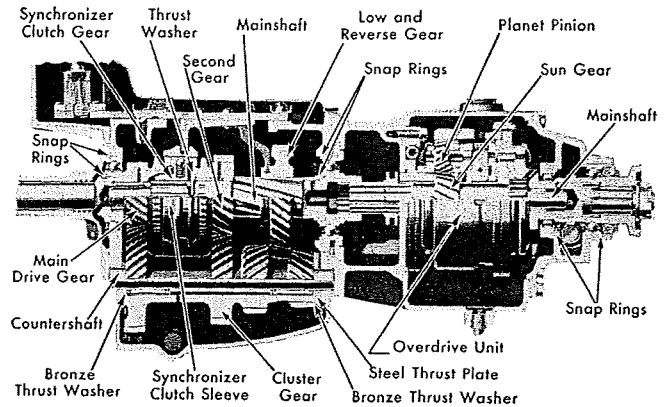


Fig. 45—Group No. 4 Transmission and Overdrive

NOTE—When installing the second speed gear, check its end play by inserting a feeler gauge between the back face of the gear and the butt end of a spline on the mainshaft. End play should be from .003" to .008" and if not within these limits, thrust washers of several thicknesses are available to obtain this clearance.

SYNCHRONIZER: **NOTE**—Before disassembling this unit, mark (if not done already) the relationship of the clutch sleeve with the clutch gear so that, if disassembled, assembly may be made in the same relative position.

(7)—To disassemble the unit, wrap a cloth around the assembly to avoid losing the balls and springs; then separate the clutch sleeve from the gear.

NOTE—To assemble the unit, apply a liberal quantity of grease in the holes in the clutch gear, and also to the balls and springs. Position the balls and springs in the clutch gear. Use a clamp—similar to a ring compressor—to compress the assembly enough to enable the sleeve to be installed.

CAUTION—When replacing the synchronizer assembly on the mainshaft, be sure that the hub portion of the gear and the straight portion of the sleeve are toward the front.

REVERSE IDLER: (8)—Drive the reverse idler gear shaft out through the rear of the case and lift out the gear.

ASSEMBLE: (9)—Install the mainshaft and drive the rear bearing onto the shaft. (10)—Push the mainshaft into position and press the bearing into the case, locking it with a new snap ring. (11)—Replace the countershaft as already described. (12)—Install the overdrive assembly.

OVERDRIVE, OVERHAUL

NOTE—Although the 1935 Studebaker President transmission differs from the 1936 President, the overdrive unit is the same. Therefore, the following description applies to 1935 President cars as well.

TRANSMISSION, OVERHAUL

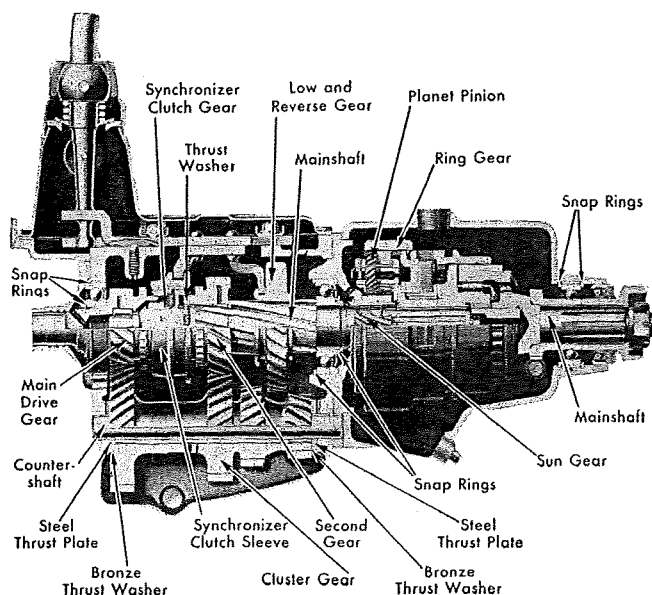


Fig. 46—Group No. 5 Transmission and Overdrive

With the overdrive removed from the transmission, proceed as follows:

(1)—Pry the shift collar lock ring out of the groove in the overdrive shaft at the front. (2)—Remove the cap screws from the rear bearing retainer and pull the retainer, together with the tail shaft and free wheel assembly out through the rear of the housing. **NOTE**—Remove the transmission brake drum on Chrysler and De Soto cars before removing the bearing retainer. (3)—Remove the clutch, the pinion cage assembly and the mainshaft from the rear of the housing.

CAUTION—The gaskets between the bearing retainer housing and the overdrive housing control the end play. Therefore, it is important that the same number of gaskets be used when assembling.

(4)—Unbolt the cap screws which fasten the sun gear and damper assembly to the housing and lift out the damper assembly.

(5)—To remove the tail shaft and free wheel from the rear bearing retainer, press the shaft out forward. (6)—Take off the lock ring and pull the oil seal and bearing out through the rear.

(7)—If necessary to disconnect the shift mechanism, unhook the control lever spring and remove the clevis pin from the control lever shaft. (8)—Detach the horseshoe lock from the rear of the shift fork by pushing the rod spring and cup forward—which will release the lock from the groove in the shift rod. (9)—

Take out the rod from the forward end of the housing and lift out the rod spring and shift fork.

NOTE—Reverse the order of the above procedure to assemble the unit and always use new snap rings and lock washers. However, to control the end play between the rear bearing retainer and the overdrive housing, replace the rear bearing retainer, together with the free wheel and tail shaft assembly without using any shims or gasket. Install the two top screws in the retainer and run them up **FINGER TIGHT**. Now measure the clearance between the gasket faces of the housing and the retainer—using a feeler gauge. To this measurement, add not less than .015" of shims. The total measurement thus obtained indicates the thickness of shims to be installed between the housing and the retainer.

GROUP No. 5

Figs. 46, 47, 48, 49

CHRYSLER 1935-38, C6, CZ, C7, C8, C14, C16, C18.

DE SOTO 1935-38, SF, S1, S3, S5.

DODGE 1935-38 ALL

PLYMOUTH 1935-38 ALL and P7, 1939

WARNER T86, T88

WITHOUT OVERDRIVE

SHIFT MECHANISM: (1)—Remove the shift rail retainer screws and lift out the shift rail and fork assemblies. **NOTE**—Take out the balls and springs from the front end of the case under the shift rails.

MAINSHAFT: (2)—Lock the transmission in two gears to prevent the mainshaft from turning. (3)—Using a suitable puller, take off the transmission companion flange and brake drum assembly. (4)—Withdraw the mainshaft assembly through the rear of the case, being careful not to damage the synchronizer.

NOTE—Before disassembling the mainshaft, mark the relationship of the synchronizer clutch sleeve with the clutch gear so that, if disassembled, assembly may be made in the original position.

(5)—Slip the synchronizer from the mainshaft. (6)—Remove the second speed gear by using a suitable pointed tool through a hole in the second speed gear thrust washer and depress the spring plunger. (7)—Turn the washer until its splines align with the grooves on the mainshaft, after which, the washer and second speed gear can be removed from the shaft.

NOTE—After installing the second speed gear, check its end play by inserting a feeler gauge between the back face of the gear and the butt end of a spline on the mainshaft. End play should be from .003" to .008" and if not within these limits, thrust washers

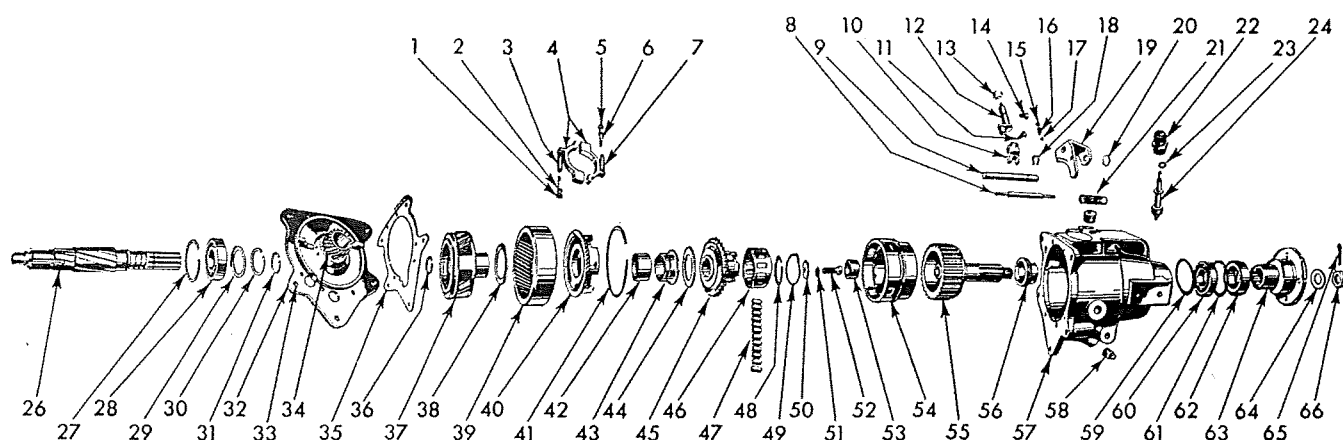


Fig. 47—Group No. 5 Overdrive

- | | | | |
|---------------------------------------|------------------------------------|-----------------------------------|--------------------------------------|
| 1—Clutch pawl adjusting screw—slotted | 17—Poppet ball | 34—Sun gear | 50—Cam retaining washer |
| 2—Adjusting screw washer | 18—Shift rail "C" washer | 35—Overdrive housing gasket | 51—Lock washer |
| 3—Adjusting screw spring | 19—Shift rail fork | 36—Planet pinion cage snap ring | 52—Cam retaining washer screw |
| 4—Clutch pawls | 20—Shift rail expansion plug | 37—Planet pinion cage | 53—Overdrive mainshaft pilot bushing |
| 5—Clutch pawl adjusting screw | 21—Shift rail fork spring | 38—Clutch pawl core thrust washer | 54—Clutch pawl shell |
| 6—Adjusting screw washer | 22—Speedometer drive pinion sleeve | 39—Ring gear | 55—Overdrive mainshaft |
| 7—Adjusting screw spring | 23—Oil seal | 40—Clutch pawl core | 56—Speedometer drive gear |
| 8—Reverse lock-up plunger | 24—Speedometer drive pinion | 41—Ring gear snap ring | 57—Overdrive housing |
| 9—Control shift rail | 25—Mainshaft | 42—Clutch pawl core hub bushing | 58—Drain plug |
| 10—Control shift rail lug | 26—Mainshaft | 43—Clutch pawl core hub | 59—Snap ring |
| 11—Shift rail set screw | 27—Snap ring | 44—Free wheel cam thrust washer | 60—Bearing |
| 12—Control shaft | 28—Bearing | 45—Free wheel cam | 61—Snap ring |
| 13—Control shaft oil seal | 29—Bearing washer | 46—Free wheel roller retainer | 62—Oil seal |
| 14—Control shaft locating screw | 30—Bearing snap ring | 47—Free wheel rollers | 63—Mainshaft flange |
| 15—Poppet spring seat | 31—Sun gear snap ring | 48—Roller retainer snap ring | 64—Flange nut washer |
| 16—Poppet spring | 32—Adapter gasket | 49—Roller retainer spring | 65—Cotter pin |
| | 33—Adapter | | 66—Flange nut |

of several thicknesses are available to obtain this clearance.

SYNCHRONIZER: (8)—To disassemble this unit, wrap a cloth around the assembly to avoid losing the balls and springs; then separate the clutch sleeve from the gear.

NOTE—To assemble the unit, apply a liberal quantity of grease in the holes in the clutch gear, and also to the balls and springs. Position the balls and springs in the clutch gear. Use a clamp—similar to a ring compressor—to compress the assembly enough to enable the sleeve to be installed.

CAUTION—When replacing the synchronizer assembly on the mainshaft, be sure that the hub portion of the gear and the tapered portion of the sleeve are toward the front.

MAIN DRIVE GEAR: **NOTE**—Before this assembly can be removed, the countershaft must be driven out, allowing the countergear cluster to lie in the bottom of the case. See the COUNTERSHAFT paragraph.

(9)—Take off the main drive gear bearing retainer and, after removing the snap ring, pull the main drive gear assembly out rearward.

NOTE—Before installing the gear, be sure to place the countergear assembly in the bottom of the case, but DO NOT install the countershaft until after the main drive gear is in position.

COUNTERSHAFT: (10)—Remove the countershaft locking plate and, using a dummy shaft (or

arbor) to hold the needle bearings in place, drive the shaft out rearward, allowing the countergear assembly to lie in the bottom of the case until the main drive gear is removed—as already explained.

NOTE—To install the assembly: (a)—Insert the bearing spacer into the gear and then, install the dummy shaft (or arbor) which was used when removing the assembly. (b)—Apply a liberal amount of cup grease at each end of the gear and insert the needle bearings. (c)—After the needle bearings are properly inserted, place a steel thrust plate at each end of the gear, and a bronze thrust washer at each end of the assembly, using cup grease to hold them in position. (d)—Place the entire assembly into the case and, before installing the regular countershaft, replace the main drive gear assembly. (c)—Position the countergear assembly and drive the dummy out by installing the regular countershaft through the rear.

NOTE—The end play of the countershaft should be from .002" to .008" and can be checked by forcing the assembly toward the front. Then insert a feeler gauge between the thrust washer and the case at the rear. Thrust washers are available in several thicknesses to obtain this clearance.

REVERSE IDLER: Lift the reverse idler out of the case after driving the shaft out through the rear.

ASSEMBLE: Reverse the order of removal to assemble the transmission. To insure a proper fit in their grooves, snap rings which have been removed should be replaced with new ones.

TRANSMISSION, OVERHAUL

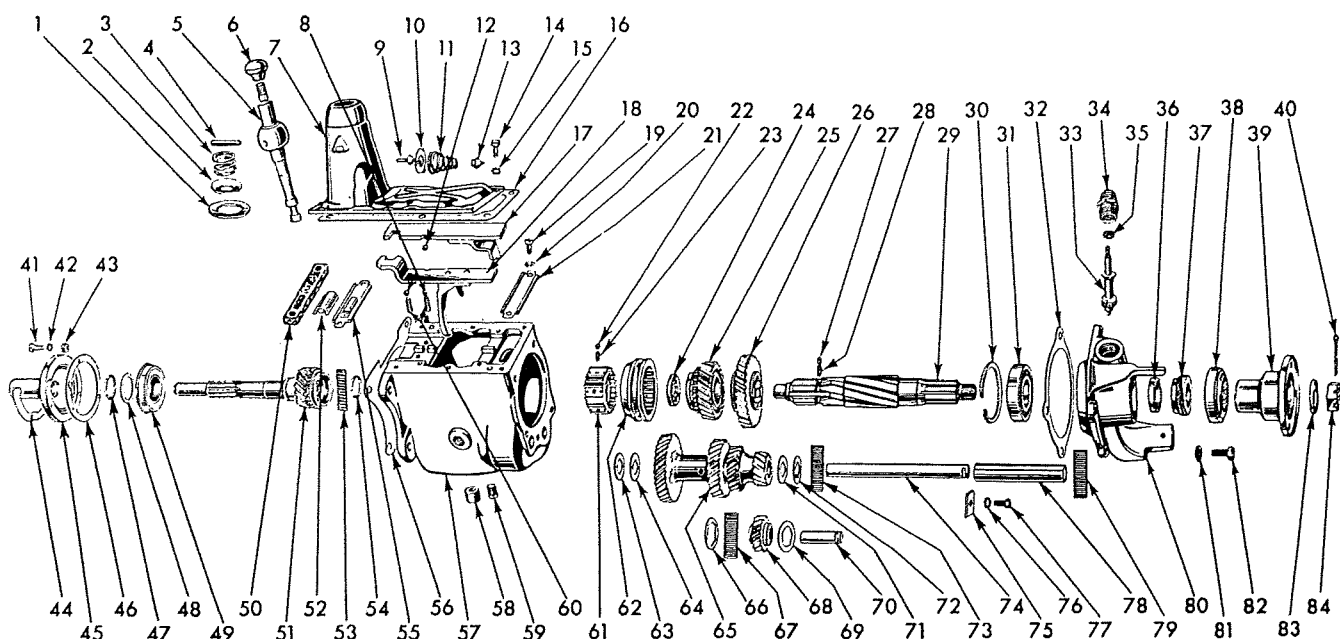


Fig. 48—Group No. 5 Transmission

- | | | | |
|--------------------------------------|------------------------------------|-------------------------------------|---------------------------------------|
| 1—Shift lever friction plate support | 22—Clutch gear ball | 43—Grommet | 64—Thrust plate |
| 2—Shift lever friction plate | 23—Clutch gear spring | 44—Pull-back spring clip | 65—Cluster gear |
| 3—Shift lever friction plate spring | 24—Second gear thrust washer | 45—Bearing retainer | 66—Reverse idler gear washer |
| 4—Shift lever locating pin | 25—Second gear | 46—Bearing retainer gasket | 67—Reverse idler gear bearing rollers |
| 5—Shift lever | 26—Low and reverse gear | 47—Snap ring | 68—Reverse idler gear |
| 6—Shift lever knob | 27—Thrust washer pin | 48—Washer | 69—Reverse idler gear washer |
| 7—Gearshift housing | 28—Thrust washer pin spring | 49—Bearing | 70—Reverse idler shaft |
| 8—Shift rail selector balls | 29—Mainshaft | 50—Shift rail retainer oil seal | 71—Thrust washer |
| 9—Thrust spring housing pin | 30—Snap ring | 51—Main drive gear | 72—Thrust plate |
| 10—Thrust spring cup | 31—Bearing | 52—Shift rail retainer roller cap | 73—Countershaft bearing rollers |
| 11—Thrust spring | 32—Gasket | 53—Mainshaft pilot bearing rollers | 74—Countershaft |
| 12—Shift rail interlock ball | 33—Speedometer drive pinion | 54—Snap ring | 75—Lock plate |
| 13—Thrust spring ball | 34—Speedometer drive pinion sleeve | 55—Shift rail retainer—front | 76—Lock washer |
| 14—Gearshift housing screw | 35—Oil seal | 56—Gasket | 77—Lock plate screw |
| 15—Lockwasher | 36—Speedometer drive gear spacer | 57—Transmission housing | 78—Bearing spacer |
| 16—Gearshift housing gasket | 37—Speedometer drive gear | 58—Filler plug | 79—Countershaft bearing rollers |
| 17—Low and reverse rail and fork | 38—Bearing oil seal | 59—Drain plug | 80—Transmission brake support |
| 18—Second and high rail and fork | 39—Mainshaft flange | 60—Shift rail selector ball springs | 81—Lock washer |
| 19—Shift rail retainer screw | 40—Cotter pin | 61—Synchronizer clutch gear | 82—Screw |
| 20—Retainer screw lockwasher | 41—Bearing retainer screw | 62—Synchronizer clutch sleeve | 83—Washer |
| 21—Gearshift rail retainer—rear | 42—Lockwasher | 63—Thrust washer | 84—Flange nut |

WITH OVERDRIVE

NOTE—If repairs are to be made on the overdrive **ONLY**, it is not necessary to dismantle the transmission unless the sun gear or adapter plate is to be replaced.

(1)—Take off the nut from the end of the overdrive tail shaft. (2)—Use a puller to remove the flange and brake drum assembly. (3)—Remove the speedometer pinion. (4)—Unbolt the overdrive case from the transmission case and slide the overdrive case rearward. **NOTE**: It may be necessary to tap the end of the overdrive shaft lightly to prevent the internal parts from coming away with the case.

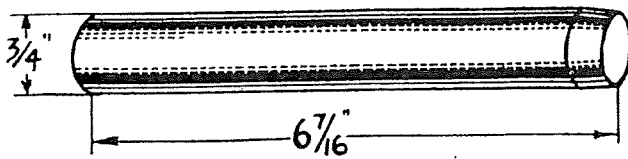
(5)—Hold one hand under the free wheel roller retainer to catch the rollers as the overdrive tail shaft is pulled rearward. (6)—The free wheel retainer and hub bushing can now be slipped off after first removing the retaining cap screw. (7)—Disengage the ring gear and clutch assembly from the pinions. **NOTE**: If necessary to remove the clutch from the ring gear, mark

the relationship of these parts so that installation may be made in the original position; then remove the snap ring which holds these parts together.

(8)—Slide off the pinion cage thrust washer and remove the pinion assembly from the shaft. (9)—Take off the adapter plate snap ring and thrust plate. (10)—Release the snap ring which retains the sun gear, after which, the sun gear and blocker assembly can be removed from the shaft.

NOTE—At this point, if repairs are to be done to the transmission, proceed as already described for these cars without overdrive. And, if it is necessary to remove the overdrive control parts from the overdrive case, proceed as follows, paying particular attention to the arrangement of the parts.

(11)—Loosen the lock screw and take out the overdrive shift control lever, after which, the overdrive shift control lever and shaft may be removed. (12)—To remove the overdrive shift yoke, back out the lock screws, remove the plug, and loosen the retaining screw



Take a punch or steel bar $\frac{3}{4}$ " round. Cut to $6\frac{7}{16}$ " length, overall. Make $\frac{1}{8}$ " 45 degree chamfer on one end. Use to drive out countershaft on Chrysler, De Soto, Dodge and Plymouth 1935-1942.

Fig. 49—Group No. 5 Countershaft Arbor

which will permit the removal of the shift shaft, fork and spring.

ASSEMBLE: Reverse the general order of procedure to assemble the unit, paying particular attention to the following remarks.

If the clutch pawl adjusting screws have been removed, they should be installed so that each screw receives the same number of turns to provide equal tension on the springs. As these springs control the cut-in speed of the overdrive both pawls should engage at the same time. The tighter these screws are turned, the higher will be the cut-in speed.

Wear on the pawl raceway of windows of the clutch sleeve produces a rasping noise at speeds above 30 MPH—which vanishes when the overdrive is engaged. A worn sleeve should be replaced, and when this is done, the clutch unit should also be installed.

When installing the free wheel rollers, use a rubber band to hold them in position and install the free wheel rollers in position.

If the reverse plunger has been removed, be sure to install it in the overdrive housing with the long portion of its small diameter to the front.

Some assemblies are provided with spring-loaded split planetary pinions. If equipped with this type, be sure to wind up the free portion of each pinion before meshing the pinions with the ring gear. The amount of wind-up is about $1\frac{1}{2}$ teeth.

GROUP No. 6

Figs. 50, 51

CHRYSLER 6, 1939. DE SOTO and DODGE, 1939. PLYMOUTH P8, 1939

WITHOUT OVERDRIVE

SHIFT MECHANISM: (1)—Remove the shift rail retainer screws and lift out the shift rail and fork assemblies. NOTE—Take out the balls and springs from the front end of the case under the shift rails.

MAINSHAFT: (2)—Lock the transmission in two gears to prevent the mainshaft from turning and, using a suitable puller, take off the transmission companion flange and brake drum assembly. (3)—Withdraw the mainshaft from the rear of the case, being careful not to damage the synchronizer.

(4)—To disassemble the mainshaft: (a)—Remove the synchronizer unit retaining snap ring from the front of the mainshaft. (b)—Pull the synchronizer

assembly, second speed gear and low and reverse gear from the shaft.

NOTE—When installing the second speed gear, check its end play by inserting a feeler gauge between the back face of the gear and the butt end of a spline on the mainshaft. End play should be from .003" to .008".

SYNCHRONIZER: (5)—To disassemble, remove the synchronizer stop rings and the front synchronizer stop ring spreader spring. Then force the clutch gear and friction ring from the clutch sleeve.

NOTE—To assemble, place the friction ring in the clutch gear with the depressions in the ring directly over the three bosses in the clutch gear. Use a light piece of welding rod to make three pins about 3 or 4 inches long. Insert these pins through the holes in the clutch gear and over the depressions in the friction ring to compress the ring so that the clutch gear and ring assembly may be installed into the clutch sleeve readily. When installed in the sleeve, the ends of the friction ring should straddle a tooth of the clutch sleeve. **CAUTION**—Don't forget to remove the pins.

MAIN DRIVE GEAR: **NOTE**—Before this assembly can be removed, the countershaft must be driven out, allowing the countergear cluster to lie in the bottom of the case. See the COUNTERSHAFT paragraph. (6)—Take off the main drive gear bearing retainer and, after removing the snap ring, pull the main drive gear assembly out rearward.

NOTE—Before installing the gear, be sure to place the countergear assembly in the bottom of the case, but **DO NOT** install the countershaft until after the main drive gear is in position.

COUNTERSHAFT: (7)—Remove the countershaft locking plate and, using a dummy shaft (or arbor) to hold the needle bearings in place, drive the shaft out rearward, allowing the countergear assembly to lie in the bottom of the case until the main drive gear is removed—as already explained.

NOTE—To install the assembly: (a)—Insert the bearing spacer into the gear and then, install the dummy shaft (or arbor) which was used when removing the assembly. (b)—Apply a liberal amount of cup grease at each end of the gear and insert the needle bearings. (c)—After the needle bearings are properly inserted, place a steel thrust plate at each end of the gear, and a bronze thrust washer at each end of the assembly, using cup grease to hold them in position. (d)—Place the entire assembly into the case and, before installing the regular countershaft, replace the main drive gear assembly. (e)—Position the countergear assembly and drive the dummy shaft out by installing the regular countershaft through the rear.

NOTE—The end play of the countershaft should be from .002" to .008" and can be checked by forcing the assembly toward the front. Then insert a feeler gauge between the thrust washer and the case at the rear. Thrust washers are available in several thicknesses to obtain this clearance.

TRANSMISSION, OVERHAUL

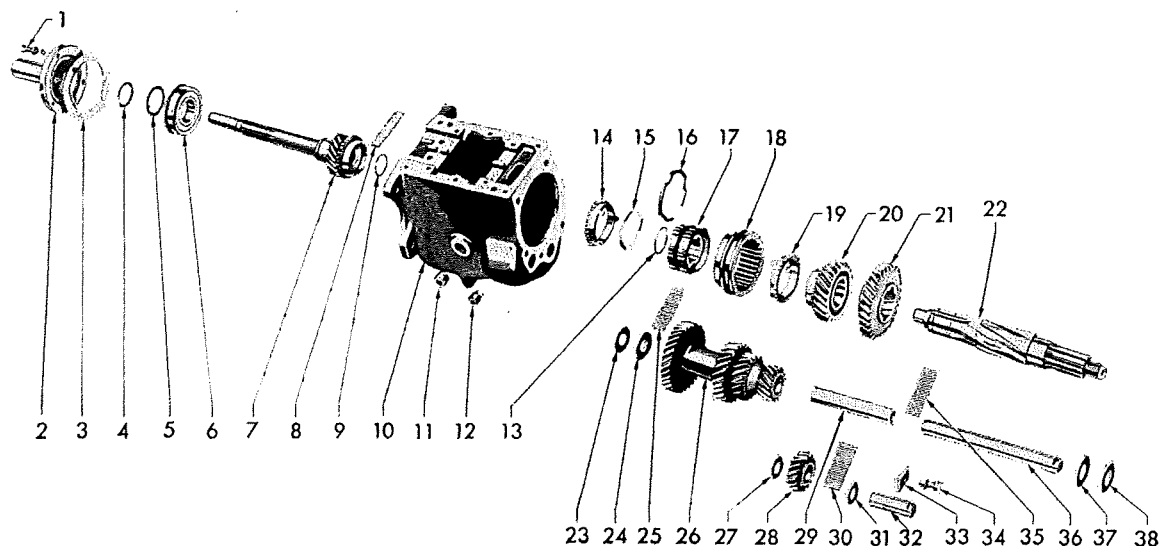


Fig. 50—Group No. 6 Transmission

- | | | | |
|---------------------------|-------------------------------|---------------------------------|---------------------------------|
| 1—Bearing retainer screw | 10—Transmission case | 20—Second gear | 30—Reverse gear rollers |
| 2—Bearing retainer | 11—Filler plug | 21—Low and reverse gear | 31—Reverse gear washer |
| 3—Bearing retainer gasket | 12—Drain plug | 22—Mainshaft | 32—Reverse idler gear shaft |
| 4—Bearing snap ring | 13—Clutch gear snap ring | 23—Thrust washer | 33—Lock plate |
| 5—Bearing washer | 14—Stop ring | 24—Thrust plate | 34—Lock plate screw and washer |
| 6—Drive gear bearing | 15—Stop ring spring | 25—Countershaft bearing rollers | 35—Countershaft bearing rollers |
| 7—Main drive gear | 16—Clutch gear friction ring | 26—Cluster gear | 36—Countershaft |
| 8—Mainshaft pilot bearing | 17—Synchronizer clutch gear | 27—Reverse gear washer | 37—Thrust plate |
| 9—Pilot bearing snap ring | 18—Synchronizer clutch sleeve | 28—Reverse idler gear | 38—Thrust washer |
| | 19—Stop ring | 29—Bearing spacer | |

REVERSE IDLER: (8)—Lift the reverse idler out of the case after driving the shaft out through the rear.

ASSEMBLE: Reverse the order of removal to assemble the transmission. To insure a proper fit in their grooves, snap rings which have been removed should be replaced with new ones.

TRANSMISSION & OVERDRIVE, OVERHAUL

NOTE—If repairs are to be made on the overdrive **ONLY**, it is not necessary to dismantle the transmission unless the sun gear or adapter plate is to be replaced.

(1)—Take off the nut from the end of the overdrive tail shaft. (2)—Use a puller to remove the flange and brake drum assembly. (3)—Remove the speedometer pinion. (4)—Unbolt the overdrive case from the transmission case and slide the overdrive case rearward. **NOTE**—It may be necessary to tap the end of the overdrive shaft lightly to prevent the internal parts from coming away with the case.

(5)—Hold one hand under the free wheel roller retainer to catch the rollers as the overdrive tail shaft is pulled rearward. (6)—The free wheel retainer and hub bushing can now be slipped off after first removing the retaining cap screw. (7)—Disengage the ring gear and clutch assembly from the pinions. **NOTE**—If necessary to remove the clutch from the ring gear, mark the relationship of these parts so that installation may be made in the original position; then remove the snap ring which holds these parts together.

(8)—Slide off the pinion cage thrust washer and remove the pinion assembly from the shaft. (9)—Take off the adapter plate snap ring and thrust plate. (10)—

Detach the solenoid from the adapter plate and remove the solenoid pawl and plunger. (11)—Release the snap ring which retains the sun gear, after which, the sun gear and blocker assembly can be removed from the shaft.

NOTE—At this point, if repairs are to be done to the transmission, proceed as already described for these cars without overdrive. And, if it is necessary to remove the overdrive control parts from the overdrive case, proceed as follows, paying particular attention to the arrangement of the parts.

(12)—Loosen the lock screw and take out the overdrive shift control lever, after which, the overdrive shift control lever and shaft may be removed. (13)—To remove the overdrive shift yoke back out the lock screws, remove the plug, and loosen the retaining screw which will permit the removal of the shift shaft, fork and spring.

ASSEMBLE: Reverse the general order of procedure to assemble the unit, paying particular attention to the following remarks.

If the clutch pawl adjusting screws have been removed, they should be installed so that each screw receives the same number of turns to provide equal tension on the springs. As these springs control the cut-in speed of the overdrive, both pawls should engage at the same time. The tighter these screws are turned, the higher will be the cut-in speed.

Wear on the pawl raceway or windows of the clutch sleeve produces a rasping noise at speeds above 30 MPH—which vanishes when the overdrive is engaged. A worn sleeve should be replaced, and when this is done, the clutch unit should also be installed.

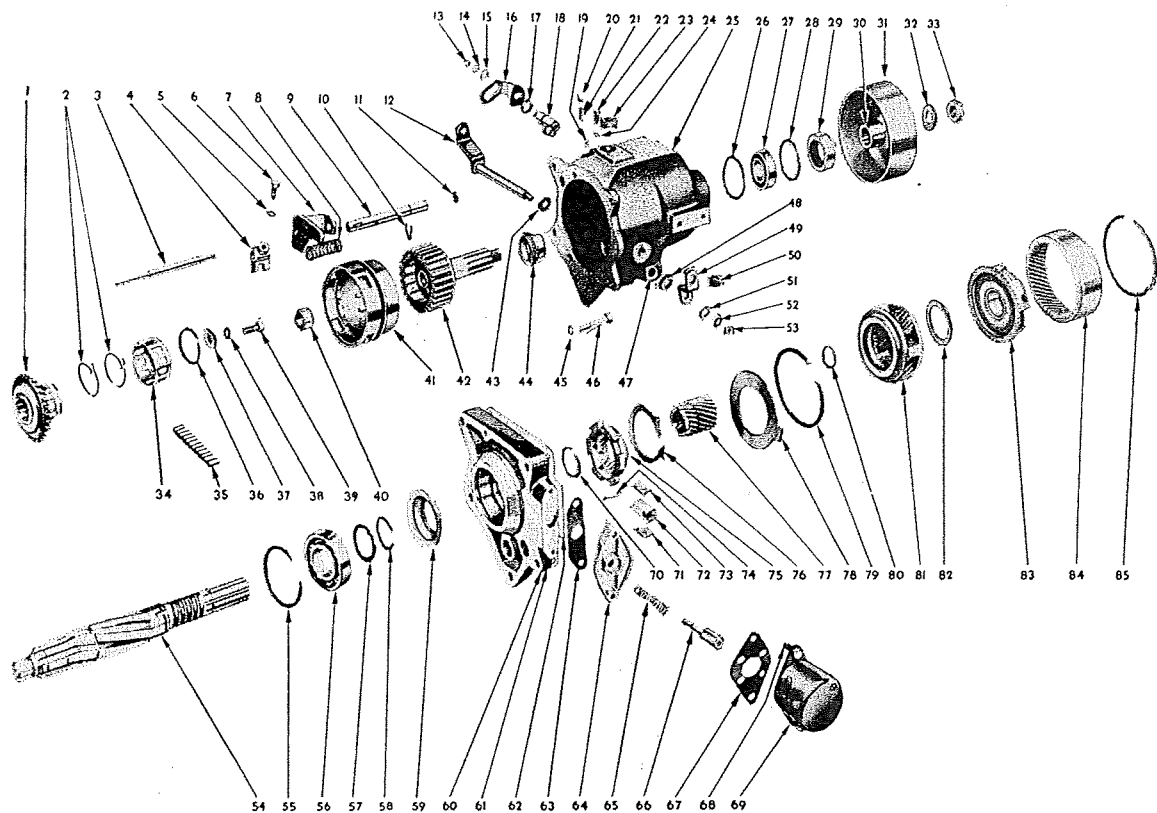


Fig. 51—Group No. 6 Overdrive

- | | | | |
|------------------------------|-----------------------------|----------------------------|---------------------------------|
| 1—Free wheel cam | 23—Inspection hole plug | 44—Speedometer drive gear | 65—Solenoid core spring |
| 2—Roller retainer springs | 24—Locating screw washer | 45—Housing screw washer | 66—Solenoid core |
| 3—Reverse lockup plunger | 25—Housing | 46—Housing screw | 67—Solenoid gasket |
| 4—Control shift rail lug | 26—Bearing snap ring, front | 47—Cross shaft bushing | 68—Solenoid screw and washer |
| 5—Lug set screw washer | 27—Mainshaft bearing | 48—Cross shaft oil seal | 69—Solenoid |
| 6—Lug set screw | 28—Bearing snap ring, rear | 49—Cross shaft lever, left | 70—Sun gear snap ring |
| 7—Control shift fork | 29—Mainshaft oil seal | 50—Drain plug | 71—Sun gear pawl plate |
| 8—Shift fork spring | 30—Mainshaft flange | 51—Cross shaft nut washer | 72—Sun gear pawl |
| 9—Control shift rail | 31—Brake drum | 52—Lockwasher | 73—Sun gear pawl plate |
| 10—Shift rail "C" washer | 32—Flange nut washer | 53—Cross shaft nut | 74—Pawl plate pin |
| 11—Shift rail expansion plug | 33—Flange nut | 54—Transmission mainshaft | 75—Sun gear balk ring and plate |
| 12—Control cross shaft | 34—Roller retainer | 55—Rear bearing snap ring | 76—Sun gear balk ring |
| 13—Control shaft nut | 35—Free wheel rollers | 56—Mainshaft rear bearing | 77—Sun gear |
| 14—Control shaft lock washer | 36—Cam snap ring | 57—Bearing washer | 78—Sun gear cover plate |
| 15—Control shaft nut washer | 37—Cam retaining washer | 58—Rear bearing snap ring | 79—Cover plate snap ring |
| 16—Control lever | 38—Lockwasher | 59—Oil baffle | 80—Pinion cage snap ring |
| 17—Control shaft oil seal | 39—Washer screw | 60—Adapter gasket | 81—Planet pinion cage |
| 18—Control shaft | 40—Mainshaft pilot bushing | 61—Adapter | 82—Thrust washer |
| 19—Shift rail poppet ball | 41—Clutch pawl shell | 62—Adapter gasket | 83—Clutch pawl and core |
| 20—Ball spring seat | 42—Overdrive mainshaft | 63—Solenoid base gasket | 84—Ring gear |
| 21—Poppet ball spring | 43—Cross shaft oil seal | 64—Solenoid base and seal | 85—Ring gear snap ring |
| 22—Shaft locating screw | | | |

The clearance between the solenoid pawl and the balk ring should be .015" with the solenoid in place and energized. Adjust the clearance by adding gaskets under the solenoid unit.

When installing the free wheel rollers, use a rubber band to hold them in position.

If the reverse plunger has been removed, be sure to install it in the overdrive housing with the long portion of its small diameter to the front.

When assembling the planetary pinions to the ring gear, be sure to wind up the free portion of each pinion before installing the ring gear. The wind-up should be about 1½ teeth.

GROUP No. 7

Fig. 52

HUDSON 1941-42 ALL WITHOUT OVERDRIVE

CLUTCH HOUSING: (1)—Disconnect the clutch housing from the transmission case and remove the housing.

NOTE—The housing contains the main drive gear bearing retainer and oil seal. If the oil seal is to be replaced, tap the bearing retainer out toward the rear. The oil seal may then be driven out of the retainer.

TRANSMISSION, OVERHAUL

When replacing the retainer, match its retaining pin with the hole in the clutch housing.

SHIFT RAILS & FORKS: (2)—Remove the screws and lift off the transmission cover carefully to prevent the shift rail lock spring from jumping out, then take out the spring and ball. (3)—Remove the lock screws and slide the low and reverse shaft rail out through the front of the case. (4)—Lift out the reverse shifter and shift fork. (5)—Tilt the transmission on its side and take out the shift rail interlock. (6)—Remove the set screw and slide the second and high shift rail out of the case, then remove the fork. (7)—Tilt the transmission on its side to allow the lock ball and spring to drop out.

NOTE—When replacing, (a)—Install one ball and spring. (b)—Place the second and high shift fork into the groove in the synchronizer sleeve. (c)—Slide the rail through the fork. (d)—Replace the lock screw. (e)—Drop the shift rail interlock into its hole. (f)—Install the low and reverse shifter behind the shift shaft inner lever and slide the shift rail through the shifter. (g)—Replace the fork, push the rail through the fork and into the case, then replace the lock screws.

CAUTION—The heavier lock ball spring should always be used under the low and reverse shift rail.

MAINSHAFT: **NOTE**—If the mainshaft rear bearing, speedometer gear housing oil seal or the speedometer gear is NOT to be replaced, it is not necessary to remove the companion flange. If equipped with vacuum clutch control, unscrew the governor switch from the speedometer gear housing, and remove the lock ring to take out the governor pinion.

(8)—Remove the transmission companion flange nut and washers and, if the flange will not come off readily, use a puller to remove it from the mainshaft. (9)—Unbolt the speedometer gear housing from the transmission case and take out the speedometer gear and oil seal. (10)—Slide the mainshaft assembly back out of the main drive gear. (11)—Remove the snap ring from the front of the mainshaft. (12)—Grasp the mainshaft gears and synchronizer assembly and withdraw the mainshaft through the gears and out of the case through the rear.

CAUTION—When assembling, be sure to install the low and reverse gear on the mainshaft so that the oil holes in the shift yoke groove of the gear line up with the grooves on the mainshaft. Place the second speed gear on the shaft with the tapered side of the hub toward the front.

SYNCHRONIZER: **NOTE**—Before dismantling the synchronizer unit, mark the relationship of the synchronizer rings and the clutch sleeve so that assembly may be made in the original position.

(13)—Remove the synchronizer rings from the assembly. (14)—Unhook the synchronizer springs from

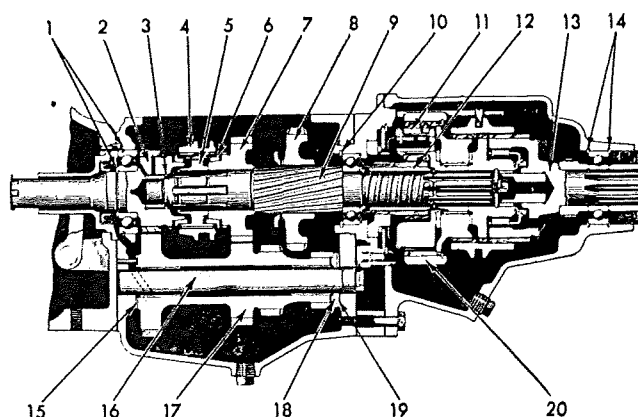


Fig. 52—Group No. 7 Transmission and Overdrive

- | | |
|-----------------------------|------------------------|
| 1—Snap rings | 11—Planet pinion |
| 2—Main drive gear | 12—Sun gear |
| 3—Pilot bearing snap ring | 13—Overdrive mainshaft |
| 4—Synchroizer clutch sleeve | 14—Snap rings |
| 5—Synchroizer clutch gear | 15—Thrust washer |
| 6—Stop ring | 16—Countershaft |
| 7—Second gear | 17—Cluster gear |
| 8—Low and reverse gear | 18—Thrust plate |
| 9—Mainshaft | 19—Thrust washer |
| 10—Snap ring | 20—Overdrive ring gear |

the shifting plates. (15)—Slide the clutch sleeve from the clutch gear.

NOTE—To assemble, place the three shifting plates in the clutch sleeve and install the clutch gear in the sleeve. Install the two synchronizer spreader springs, being sure that one of the turned out ends of each spring is inserted in opposite ends of the same shifting plate. Then replace the synchronizer rings so that the cut-outs engage the shifting plates. Place the assembly on the mainshaft with the tapered side of the shift sleeve toward the front.

CAUTION—Some synchronizer rings and sleeves have been made with a 110-degree chamfer on the cones or teeth and some with a 90 degree. A 110-degree ring or sleeve cannot be used with a 90 degree part. The 110-degree sleeve is marked with a groove on the outside face while the 110-degree ring is marked "110" on the flange face.

COUNTERSHAFT: (16)—Remove the countershaft lock and drive the countershaft out through the rear of the case, allowing the cluster gear to lie in the bottom of the case until after the main drive gear is removed; then, lift out the cluster gear and thrust washers.

NOTE—When replacing the assembly, be sure to place a bronze thrust washer at the front, and a bronze and steel washer at the rear of the gear—with the steel washer located between the bronze washer and the gear.

REVERSE IDLER: (17)—The reverse idler gear may be lifted out of the case after driving the reverse idler gear shaft out toward the rear.

MAIN DRIVE GEAR: (18)—Before lifting out the countergear cluster, pull the main drive out through the front of the case.

CAUTION—Before replacing the main drive gear, place the countergear and thrust washers in the bottom of the case, but do not install the countershaft until the main drive gear is replaced.

SHIFT LEVERS & SHAFTS: (19)—Remove the nut and washers and take off the outer shift selector lever. (20)—Unfasten the set screw which retains the shift selector shaft bushing. (21)—Take the shift selector lever and shaft out from the inside of the case and pull the shift selector bushing out from the top. (22)—**CAUTION**—Before removing the shift shaft inner lever and shaft, punch-mark the relationship of these parts so they may be installed in the original position. Then, remove the nut and washers and take-out the shift shaft outer lever. (23)—Using a punch, drive out the shift shaft pin. (24)—Remove the shift shaft inner lever and withdraw the shaft and felt.

ASSEMBLE: The transmission is assembled in the reverse numerical order of disassembly.

TRANSMISSION & OVERDRIVE

NOTE—The transmission which is used in conjunction with overdrive is constructed exactly the same as the one without overdrive. If repairs are to be made on the overdrive only, it is not necessary to dismantle the transmission unless the adapter plate or transmission rear bearing is to be replaced.

(1)—Disconnect the overdrive case from the adapter plate and pull off the overdrive case together with the overdrive mainshaft, clutch sleeve and shifter rail reverse lock-up plunger.

(2)—Unbolt the free wheeling cam from the end of the transmission mainshaft and slide the assembly off the shaft.

NOTE—The overdrive clutch pawl and core assembly, together with the pinion cage assembly should be removed as a unit to eliminate the necessity of rewinding the split pinions, since these parts cannot be obtained separately. Care should be exercised however, not to damage the oil thrower on the front face of the pinion cage.

(3)—Remove the pinion cage snap ring and take out the pinion cage oil collector ring cover. (4)—Remove the solenoid and the plunger pawl by pulling it to the rear and sliding it off the ball.

NOTE—If necessary to remove the transmission mainshaft at this point, follow the procedure as already described for cars without overdrive.

(5)—To disassemble the overdrive case, remove the lock-up plunger from the front of the case. (6)—Remove the speedometer drive pinion and sleeve. (7)—Pull off the universal joint flange with a suitable puller, and remove the overdrive mainshaft through the front. (8)—Lift out the clutch sleeve. (9)—Remove the overdrive mainshaft bearing inner snap ring and tap the bearing out through the front, and then, tap the oil seal out towards the rear.

NOTE—If necessary to remove the overdrive control shaft, pay particular attention to the way the re-

lated parts are removed to insure proper assembly. When installing the poppet ball, spring and spring seat, do not adjust the seat too tightly to prevent the free movement of the control shaft lever.

ASSEMBLE

If a new oil seal is required for the overdrive mainshaft, soak it in light engine oil and work it with a steel roller so that it becomes soft and pliable. When installed, it should protrude $\frac{9}{32}$ " from the outer edge of the case.

CLUTCH PAWL & CORE ASS'Y: When replacing the clutch pawl adjusting screws, install them so that each screw receives the same number of turns to provide equal tension on the springs. As these springs control the cut-in speed of the overdrive, both pawls of the clutch should engage at the same time. Therefore, the screws should be turned in until the top of the screw heads are exactly $\frac{1}{16}$ " below the top edge of the counterbore. The tighter the screws are turned, the higher the cut-in speed.

CLUTCH SLEEVE: Wear on the pawl raceway or windows of the shifter clutch sleeve produces a rasping noise above 30 MPH which vanishes when the overdrive is engaged. A worn sleeve should be replaced and when this is done, the centrifugal clutch unit should be replaced.

PLANETARY PINIONS: These pinions are the spring-loaded split type which are designed to prevent gear backlash noise. When installing, be sure to wind up the free portion of each pinion until the tooth marks align, before meshing pinions into the ring gear. The amount of windup is about $1\frac{1}{2}$ teeth.

STATIONARY GEAR PAWL: The clearance between the solenoid pawl and the balk ring should be .015" with the pawl out to the maximum amount of travel. Adjust the clearance by adding gaskets under the solenoid unit.

FREE WHEEL CAM: Install the free wheel cam and rollers by holding the rollers in place with cup grease and a tight fitting rubber band. Turn the low point of the cam to the top. Insert the clutch sleeve in the case with the windows to the front and finger engaged in slot. Be sure to install the reverse lock-out rod.

GROUP No. 8

Fig. 53

AUBURN 6, 1933-36. HUPMOBILE 1935-36,
517W, 518D, 521J, 618D, 618G
PIERCE ARROW 1935-38 ALL
STUDEBAKER 1933-35 ALL
WARNER T83

WITHOUT FREE WHEEL OR OVERDRIVE

SHIFT MECHANISM: (1)—Remove the transmission cover screws and lift off the cover and shift lever assembly. **NOTE**—The shift rails and forks are contained in the cover and if necessary to disassemble, loosen the shift fork lock screws and drive the shift rails out of the cover and forks.

TRANSMISSION, OVERHAUL

COUNTERSHAFT: NOTE—Before the main drive gear or the mainshaft assembly can be removed, the countershaft must be driven out and the counter-gear cluster allowed to remain in the bottom of the case. Similarly, before installing these assemblies, place the countergear in the bottom of the case but do not install the shaft until after these assemblies are replaced.

(2)—Remove the locking pin and drive the countershaft out rearward, using a dummy shaft or arbor of the right length to hold the thrust washers in place.

NOTE—To install the countergear assembly, insert the bearing spacer and bearings into the gear, being sure that the longer bearing is at the rear of the assembly. Install the dummy shaft or arbor which was used to remove the countershaft, place a steel thrust plate at each end of the gear and a bronze thrust washer at each end of the assembly—using cup grease to hold them in position. Install the entire assembly into the case, but DO NOT replace the countershaft until the main drive gear and mainshaft assemblies are installed. Then, align the countergear cluster and thrust washers with the holes in the case and drive the countershaft in from the rear.

MAIN DRIVE GEAR: (3)—Remove the retainer screws and pull the front bearing retainer from the main drive gear shaft. (4)—Drive the main drive gear and bearing out through the front, using a soft metal drift against the gear.

NOTE—When replacing, install the mainshaft front pilot bearing into the pocket of the main drive gear and tap the gear and its bearing in through the front of the case, using care to guide the pilot bearing over the end of the mainshaft.

MAINSHAFT: (5)—Lock the transmission in two gears to prevent the mainshaft from turning and, using a suitable puller, remove the transmission companion flange. (6)—Remove the transmission rear bearing retainer and take out the speedometer drive gear and spacer. (7)—Tap the mainshaft assembly straight back until the rear bearing is clear of the case.

(8)—To disassemble the mainshaft on all cars except Studebaker Commander and President: (a)—Insert a wire through an oil hole in the second speed gear and rotate the mainshaft until the wire passes through the bushing. (b)—Press down the spring plunger and, using another wire, push the key forward until it is clear of the thrust washer. (c)—Turn the thrust washer until it registers with the mainshaft splines and slide the washer back about $\frac{3}{8}$ " on the mainshaft. (d)—Push the key to the rear until the spring plunger engages in the slot and again depress the plunger. (e)—While depressed, push the key to the rear until it is clear of the front thrust washer. (f)—Turn the thrust washer until it registers with the mainshaft splines and slip it from the shaft. (g)—Remove the gears from the mainshaft.

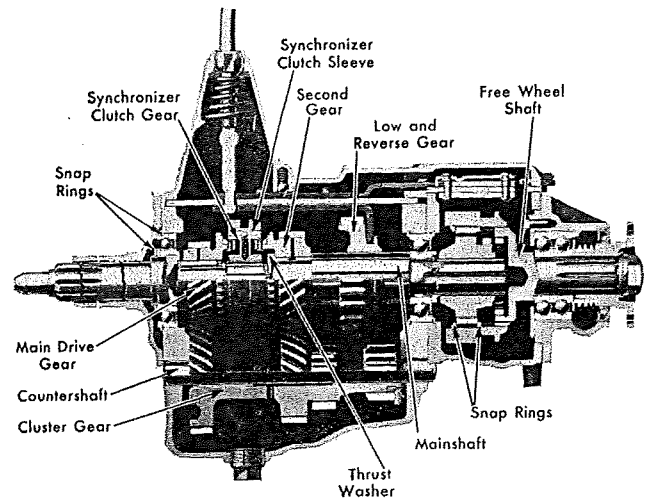


Fig. 53—Group No. 8 Transmission and Free Wheel

To disassemble the mainshaft on Studebaker Commander and President models: (a)—Remove the second speed gear by using a suitable pointed tool through a hole in the second gear thrust washer and depress the spring plunger. (b)—Turn the washer until its splines align with the grooves on the mainshaft, after which, the washer and gears may be removed from the mainshaft.

NOTE—When assembling, install the gears on the mainshaft with the second speed thrust washers and thrust washer lock. Make sure the lock pin engages the slot, locking the thrust washers in position. Insert the mainshaft assembly through the top of the case, reversing the disassembly operation. DO NOT replace the rear bearing retainer or free wheel adapter until after the countershaft is installed.

SYNCHRONIZER: (9)—NOTE—Before disassembling the synchronizer, mark the relationship of the clutch sleeve with the clutch gear so that assembly may be made in the original position. Then wrap a cloth around the unit to avoid losing the balls and springs and push the sleeve from the gear.

To assemble the unit, apply a liberal quantity of grease in the holes in the clutch gear, and also to the balls and springs. Position the balls and springs in the clutch gear. Use a clamp—similar to a piston ring compressor—to compress the assembly enough to enable the sleeve to be installed. CAUTION—When replacing the synchronizer assembly on the mainshaft, be sure that the hub portion of the gear and the straight portion of the sleeve are toward the front.

REVERSE IDLER: (10)—After removing the countershaft from the bottom of the case, drive the reverse idler shaft out through the rear and lift out the idler gear.

NOTE—When installing, hold the idler gear in position in the case and drive the idler shaft in from the rear, making sure that the locking slot is in the correct position.

FREE WHEEL, OVERHAUL

HUPMOBILE, PIERCE ARROW, REO AND STUDEBAKER

(1)—Detach the free wheel housing from the transmission case and pull the free wheel assembly straight back. (2)—Disconnect the free wheel control. (3)—Remove the control shift rail detent plugs and spring and take off the control shift link and rod assembly, after which, the free wheel shift fork and clutch gear may be removed.

NOTE—If repairs are to be made to the transmission, the procedure is the same as already described for these cars without free wheel except for the following: There is a shoulder on the rear of the mainshaft which prevents the bearing from being removed from the rear. To remove the mainshaft and bearing from these units, tilt the front of the mainshaft upward and slide the synchronizer unit from the mainshaft. Then lower the mainshaft and tap the rear bearing forward and lift out the mainshaft by its rear end.

(4)—Pry the roller retainer snap ring out of the groove in the free wheel outer case. (5)—Remove the roller retainer and invert the free wheel assembly, jarring it on a block of wood to remove the rollers. (6)—Remove the free wheel spider, roller shoes and springs.

(7)—To remove the free wheel from its housing, take out the speedometer driven gear, unscrew the nut from the end of the free wheel shaft and pull off the universal flange, the speedometer gear and spacer. (8)—The shaft may now be pressed from the housing. (9)—To remove the bearing from the housing, take off the snap ring and press out the bearing.

NOTE—Reverse the procedure to assemble the unit and replace the rollers and related parts in the following manner. (a)—Install the spider in the clutch sleeve. (b)—Install a roller shoe and spring. (c)—Using a small screwdriver, press the shoe against the spring and insert a roller; repeating this procedure until all rollers, shoes, and springs are installed. (d)—Replace the roller retainer and lock in position with a snap ring. (e)—Make sure that the free wheel shaft front bearing is in its pocket at the rear of the transmission mainshaft. (f)—Install the unit to the transmission by rotating the free wheel shaft slightly—(if necessary) to engage the splines of the transmission mainshaft.

FREE WHEEL, OVERHAUL

AUBURN

NOTE—With the free wheel unit removed, the transmission may be serviced in exactly the same manner as already described for these cars without free wheel.

(1)—Disconnect the free wheel control cable from the lever on the side of the free wheel housing. (2)—Detach the speedometer cable. (3)—Remove the cap screws holding the free wheel housing to the transmission case. (4)—Lock the transmission in gear and take off the free wheel housing together with the drive shaft

and inner sleeve. (5)—Remove the free wheel spring from the driving sleeve by rotating it in its over-running direction while pulling it out. (6)—Take off the nut and washer from the end of the transmission mainshaft and pull the driving sleeve from the end of the mainshaft. (7)—The sliding gear sleeve can now be removed by pulling it to the rear of the driving sleeve—which will release the lock ball and spring.

ASSEMBLE: (a)—When assembling the unit, tilt the spring slightly after entering it into the sleeve. (b)—Then, with a slight pressure, twist the spring in its over-running direction which will contract it enough so it will enter the sleeve. (c)—Assemble—do not tighten—the housing bolts. (d)—Spin the starter to crank the engine and rotate the free wheel unit a few revolutions to assure proper alignment. (e)—When properly aligned, tighten the free wheel housing bolts. (f)—Check the clearance between the ends of the free wheel sleeves—which should be from .002" to .010" with the bearing end play taken up. (g)—If the adjustment must be changed, it can be accomplished by changing shims between the driving sleeve and the transmission mainshaft bearing. These shims are available in several thicknesses.

NOTE—Be sure the gasket between the transmission and free wheel housings is in position when checking the clearance.

OVERDRIVE, OVERHAUL

NOTE—For service instruction on 1935 Studebaker cars, see GROUP No. 4.

GROUP No. 9

Figs. 54, 55

FORD 1932-42; MERCURY 1939-42
FORD TRUCKS 1/2, 3/4, 1 TON 1932-42

DISASSEMBLE

(1)—Detach the universal joint from the end of the transmission mainshaft. (2)—Disconnect the mainshaft rear bearing retainer and rear engine mounting assembly. (3)—Remove the transmission cover. (4)—Unhook the spring from the clutch throwout bearing and slide the bearing from the main drive gear shaft. (5)—Unscrew the bolts which fasten the main drive gear bearing retainer and slip the retainer from the shaft. (6)—After removing the cotter pin, drive out the pin which retains the countershaft and reverse idler gear shaft in position. (7)—Remove the countershaft by driving it out toward the rear. (8)—Take out the main drive gear assembly from the front. (9)—Push the mainshaft to the rear until the rear bearing is clear of the case. (10)—Remove the rear bearing and lift the mainshaft assembly out through the top. (11)—Lift out the countershaft assembly. (12)—Drive out the reverse idler gear shaft and lift out the gear.

MAINSHAFT, DISASSEMBLE

NOTE—Before disassembling the mainshaft, mark the relationship of the synchronizer clutch sleeve with

TRANSMISSION, OVERHAUL

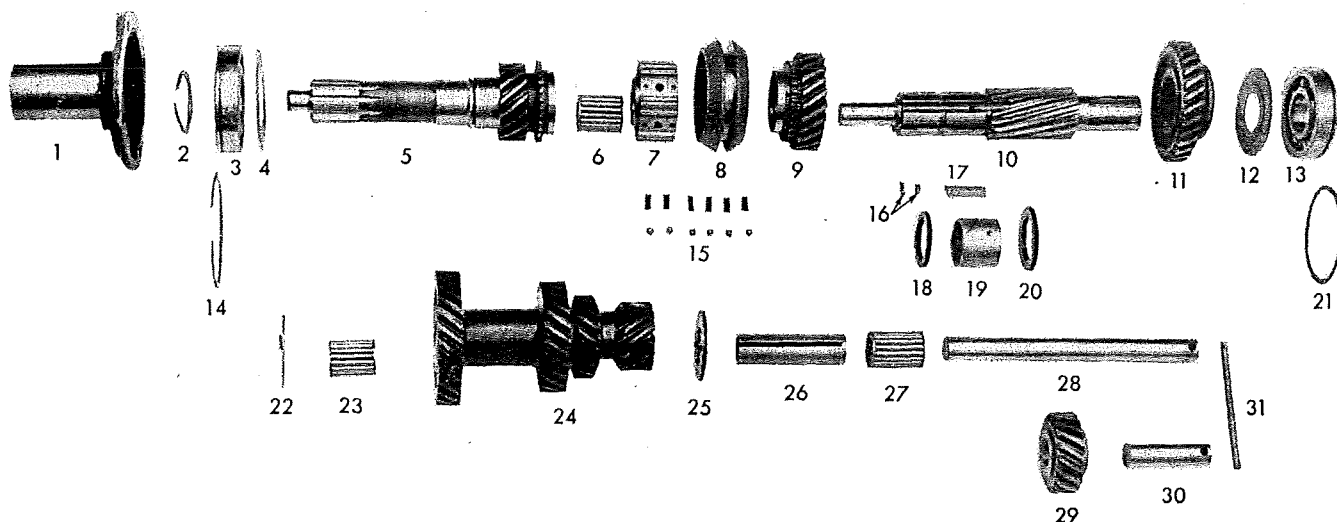


Fig. 54—Group No. 9. Ford 85, 1932-38; Some De Luxe 1939; Lincoln-Zephyr 1936-37

(Illustration above shows Ford 1936-38. Ford 1932-35 has straight splines on main shaft and straight teeth on low and reverse and idler gears)

1—Bearing retainer
2—Snap ring
3—Bearing
4—Oil baffle
5—Main drive gear
6—Mainshaft pilot bearing
7—Synchronizer clutch gear
8—Synchronizer clutch sleeve

9—Second gear
10—Mainshaft
11—Low and reverse gear
12—Oil baffle
13—Bearing
14—Snap ring
15—Clutch gear balls and springs
16—Thrust washer plunger and spring

17—Thrust washer key
18—Thrust washer
19—Second gear bushing
20—Thrust washer
21—Snap ring
22—Thrust washer
23—Countershaft bearing

25—Thrust washer
26—Bearing spacer
27—Countershaft bearing
28—Countershaft
29—Reverse idler gear
30—Reverse idler shaft
31—Lock pin

the teeth of the blocker rings so that assembly may be made in the same relative position. **CAUTION**—When replacing the synchronizer on units using 6 balls and springs, the side of the sleeve having the straight portion at the end of its taper should face toward the front. Sleeves having only one tapered side should be installed with the taper toward the front.

NOTE—The following parts apply to units using the six-ball type synchronizer. (a)—Slide the low and reverse gear from the mainshaft. (b)—Remove the synchronizer, being careful not to allow the unit to come apart during the process, otherwise the balls and springs may be lost. (c)—Take off the thrust washer from the front of the second speed gear. (d)—Insert a pointed tool through the holes in the second speed gear and depress the spring plunger. (e)—With the plunger depressed, push the locking key forward until it is clear of the rear thrust washer. (f)—Slide the gear and washers from the shaft.

NOTE—The following applies to synchronizers using the 3-balls and also to those which employ a spring retainer. (a)—Slide the low and reverse gear from the mainshaft. (b)—After taking off the spacer, remove the snap ring which retains the synchronizer in place. (c)—Slide the synchronizer unit from the shaft. (d)—The second gear and its thrust washers may now be removed.

SYNCHRONIZER

SIX-BALL RETAINER TYPE: Before disassembling, mark the relationship of the clutch gear with

the sleeve so that assembly may be made in the same relative position.

To disassemble, wrap a cloth around the assembly to avoid losing the balls and springs, then push the gear out of the sleeve.

NOTE—To assemble the unit, apply a liberal quantity of grease to the holes in the clutch gear and also to the balls and springs. Place the balls and springs in position in the clutch gear and, using a clamp—similar to a piston ring compressor—compress the assembly enough to enable the sleeve to be installed.

CAUTION—When replacing the synchronizer assembly on the mainshaft, be sure that the hub portion of the gear and the side of the sleeve having the straight portion at the end of its taper are toward the front.

THREE-BALL RETAINER TYPE: Before disassembling, be sure that the relationship of the synchronizer rings and the clutch sleeve is marked so that installation may be made in the original position.

To disassemble, wrap a cloth around the unit to avoid losing the balls, springs and shifting plates, then push the gear out of the sleeve.

NOTE—To assemble the unit, apply a liberal quantity of grease to the holes in the clutch gear and also, to the balls and springs. Place the shifting plates in position and use a clamp to compress the assembly sufficiently to enable the sleeve to be installed.

SPRING RETAINER TYPE: Push the gear out of the sleeve and take out the spring and shifting

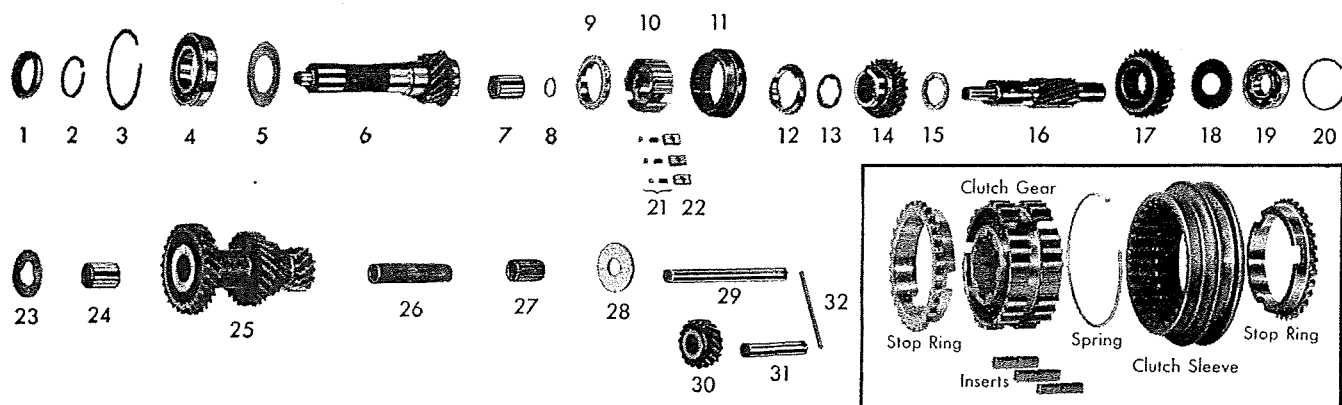


Fig. 55—Group No. 9. Ford De Luxe 1939 and All 1940-42; Mercury 1939-42

- 1—Oil seal
- 2—Snap ring, small
- 3—Snap ring, large
- 4—Bearing
- 5—Oil baffle
- 6—Main drive gear
- 7—Mainshaft pilot bearing
- 8—Spacer

- 9—Stop ring
- 10—Synchronizer clutch gear
- 11—Synchronizer clutch sleeve
- 12—Stop ring
- 13—Thrust washer
- 14—Second gear
- 15—Thrust washer
- 16—Mainshaft

- 17—Low and reverse gear
- 18—Oil baffle
- 19—Bearing
- 20—Snap ring
- 21—Clutch gear balls and springs
- 22—Shifting plates
- 23—Thrust washer
- 24—Bearing

- 25—Cluster gear
- 26—Bearing spacer
- 27—Bearing
- 28—Thrust washer
- 29—Countershaft
- 30—Reverse idler gear
- 31—Reverse idler shaft
- 32—Lock pin

plates. To assemble, position the shifting plates in the cut-outs of the gear and install the spring over the gear and into the grooves of the shifting plates. The assembly may then be installed into the sleeve but be sure that the spring is positioned properly in the groove of the sleeve.

TRANSMISSION, ASSEMBLE

The assembly procedure is the reverse of the disassembly, but attention should be paid to the following remarks.

When assembling the countershaft, the long countershaft bearing should be placed at the rear of the assembly.

When assembling the mainshaft on units equipped with the 6-ball retainer type synchronizer, make sure that the second speed gear thrust washers are locked to prevent their rotating on the mainshaft. Be sure that the spring plunger engages the locking key. If the second speed gear bushing was removed, make sure that the omitted spline on the mainshaft is directly over the locking key and plunger when replacing the bushing.

To install the mainshaft, slip the assembly into the case from above. Tilt the forward end of the shaft upward, allowing the rear of the shaft to protrude through the rear of the case. Press the rear bearing on the end of the mainshaft and install the snap ring. Then push the assembly into position in the case and replace the rear bearing retainer.

OVERDRIVE, OVERHAUL

LINCOLN ZEPHYR 1941-42

The transmission which is used in conjunction with the overdrive is of the same general construction as that which is used without overdrive except that the mainshaft in the standard transmission is replaced by one which extends into the overdrive. When assembling

the overdrive, refer to the illustration for guidance and for identification of parts, then proceed as follows:

(1)—Install the transmission mainshaft rear bearing on the mainshaft. Then, before replacing the small snap ring, determine the thickness required so that the bearing is held on the shaft, permitting the shaft to turn freely without end play. NOTE—These snap rings are available in thicknesses of .087", .090", .093", .096" and .102".

(2)—Install the transmission mainshaft oil baffle in the overdrive housing adapter plate; then assemble the mainshaft and bearing to the adapter plate.

(3)—NOTE—The transmission rear bearing snap ring (large) is available in thicknesses of .087", .090", .093" and .096", and the proper snap ring should be determined so that the bearing is held in the adapter plate without end play, yet, allowing the shaft to turn freely.

(4)—Install the sun gear plate and balk ring assembly into the rear of the adapter plate. (5)—Place the sun gear pawl in position in the adapter plate, then install the sun gear cover plate with its tongue over the pawl. (6)—Lock the cover plate by installing the snap ring in the groove in the adapter plate.

(7)—Install the interlock plunger in the hole between the sun gear pawl and the shift shaft, then place the shift assembly in position in the adapter plate.

(8)—Assemble the sun gear on the transmission mainshaft and enter the fork in the groove in the sun gear.

(9)—Install the over-running clutch on the planet pinion cage assembly, fastening the two units together with the retainer. Then place this assembly on the rear end of the transmission mainshaft, securing it to the shaft by installing the over-running clutch retainer. NOTE—When assembling the over-running clutch rollers, use a rubber band to hold them in place.

(10)—Assemble the overdrive mainshaft and internal gear assembly over the pinion cage assembly,

TRANSMISSION, OVERHAUL

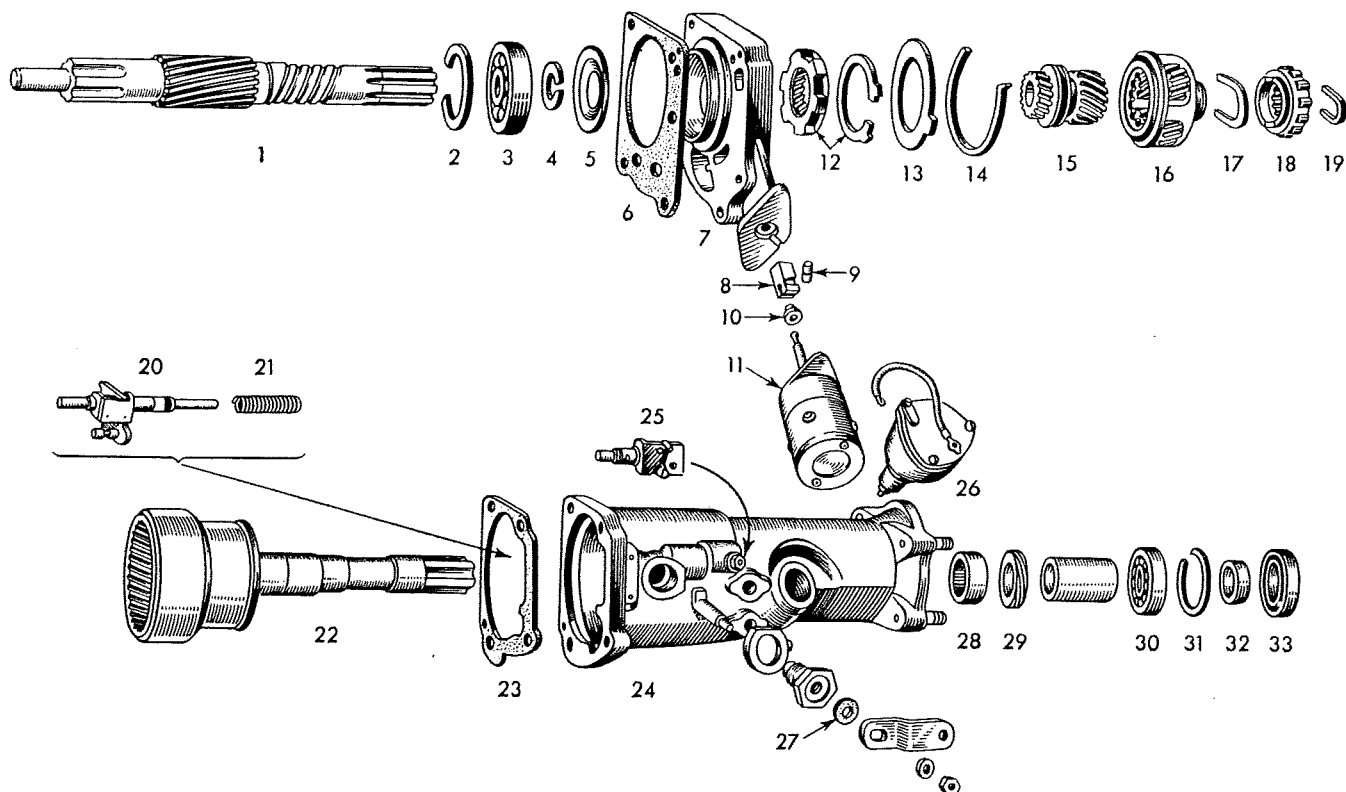


Fig. 56—Group No. 9. Overdrive on Lincoln-Zephyr

1—Transmission mainshaft
2—Snap ring
3—Mainshaft rear bearing
4—Snap ring
5—Oil baffle
6—Adapter gasket
7—Adapter
8—Sun gear pawl

9—Interlock plunger
10—Grease retainer
11—Solenoid
12—Sun gear plate and ring
13—Sun gear cover plate
14—Snap ring
15—Sun gear
16—Planet pinion cage

17—Pinion cage retainer
18—Over-running clutch
19—Clutch retainer
20—Shift shaft
21—Retractor spring
22—Mainshaft and ring gear
23—Housing gasket
24—Overdrive housing

25—Lock-out switch
26—Governor
27—Grease retainer
28—Overdrive front bearing
29—Governor drive gear
30—Rear bearing
31—Snap ring
32—Bearing spacer
33—Oil seal

pushing it forward until the over-running clutch enters its outer race. NOTE—To make assembly easier, rotate the shaft in a counter-clockwise direction.

(11)—NOTE—If replaced in service, the overdrive housing is supplied with the overdrive shaft front bearing. With the front bearing in place, install the shift shaft retractor spring in the overdrive housing, then assemble the housing to the adapter plate.

(12)—Place the governor drive gear and spacer on the overdrive mainshaft. (13)—Install the overdrive shaft rear bearing at the rear of the overdrive housing and hold it in place by using a snap ring of the proper thickness so as to eliminate end play of the bearing. NOTE—These snap rings are available in thicknesses of .062", .065", .068" and .071". (14)—Replace the oil seal and spacer at the rear of the overdrive housing.

NOTE—The governor drive gear will be free to turn on the mainshaft. However, when the universal joint is assembled to the shaft and tightened, the spacer will be forced against the gear, holding it tight enough to permit it to turn with the shaft.

(15)—Install the governor unit. (16)—Install the grease retainer in the solenoid flange on the adapter plate. (17)—Assemble the shift lever into its bushing and place the shift lever grease retainer in the hexagon end of the bushing. Then, install the shift lever in position on the shaft, assembling it to the overdrive housing with the lever in the "UP" position.

(18)—Install the lock-out switch to the housing, fastening it with the set screw. (19)—Install the solenoid to the adapter plate by inserting the stem and turning approximately 60 degrees to the right or left, pulling the unit to be sure that it is locked in the pawl before attaching the flange bolts. NOTE—When installing the solenoid, be sure that the wire terminals are facing upward. To prevent damage to the unit, it is best to install the solenoid after the overdrive is assembled to the transmission.

NOTE—On early production cars, a short floor tunnel screw is provided for the position immediately ahead of the kick-down switch, and when installing these tunnel screws, be sure that this short one is in this position. By using a longer screw in this position,

it may strike the kick-down switch upper terminals, which will result in a ground at this point. On later production cars, the kick-down switch is relocated and hence, this short screw is not required.

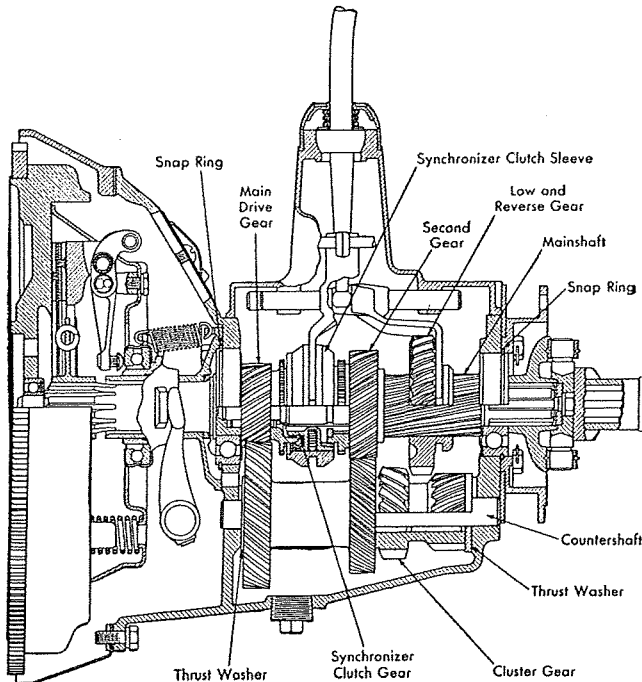


Fig. 57—Group No. 9 Transmission

GROUP No. 10

Fig. 58

LINCOLN V12 (Big). 1933-40

SHIFTER MECHANISM: (1)—Remove the screws and lift off the transmission cover assembly. (2)—If

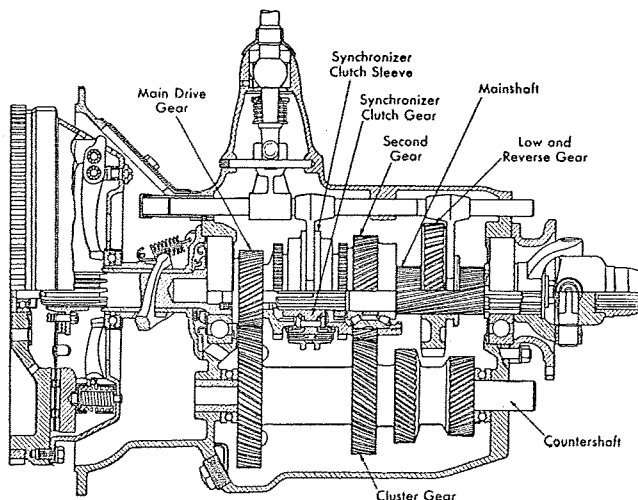


Fig. 58—Group No. 10 Transmission

the cover is to be disassembled, take out the lock pins or screws from the forks and slip the shift rails out of the forks and cover.

MAIN DRIVE GEAR: (3)—Remove the retainer screws from the front bearing retainer and pull the retainer, together with the oil deflector from the main drive gear shaft. (4)—Tap the main drive gear assembly out through the front of the case.

NOTE—To assemble, install the mainshaft front pilot bearing in the main drive gear and insert the main drive gear with the bearing through the front of the case. Drive the assembly into position, being sure that the mainshaft and pilot bearing are aligned. Replace the front bearing retainer with its gasket and oil deflector.

MAINSHAFT: (5)—Take off the cap screw and retainer washer from the end of the mainshaft and pull the universal joint yoke from the mainshaft. (6)—Remove the mainshaft rear bearing retainer by removing the nuts which fasten it to the transmission case. (7)—Drive the rear bearing out through the rear of the case, then remove it from the mainshaft. (8)—Tilt the forward end of the mainshaft upward and lift the entire assembly out through the top of the case.

To disassemble the mainshaft, (a)—Slip the synchronizer from the mainshaft, being careful not to allow the assembly to come apart during the process, otherwise the springs and balls may be lost. (b)—If the second speed gear and bearings are to be removed, unscrew the nut which retains the second speed gear front bearing and take off the gear and bearings.

SYNCHRONIZER: To disassemble the synchronizer, wrap a cloth around the unit to avoid losing the balls and springs and push the synchronizer clutch gear from the sleeve. When assembling, place the balls and springs in position and compress the assembly with a suitable clamp and install the clutch sleeve.

COUNTERSHAFT: (9)—Drive the countershaft out through the rear of the case and lift out the cluster gear and bearings.

NOTE—To assemble, install the cluster and roller bearings into the case, place a thrust bearing at each end of the assembly and drive the countershaft in through the rear of the case. It is advisable to use an arbor to align the assembly with the holes in the case before installing the countershaft.

REVERSE IDLER: (10)—Drive the reverse idler gear shaft out through the rear of the case and lift the gear out through the top.

TRANSMISSION, OVERHAUL

GROUP No. 11

Figs. 59, 60, 61

HUDSON 1932-40 ALL TERRAPLANE 1932-38 ALL

DISASSEMBLE: (1)—After removing the transmission cover, loosen the nuts from the bottom of the shift connecting rods and remove the rods and links. (2)—Disconnect the clutch housing from the transmission case and remove the housing. (3)—Use a suitable puller to take off the transmission companion flange. (4)—Disconnect the speedometer gear housing from the transmission case and remove the housing and drive gear. (5)—Remove the shift rail lock ball spring caps, ball springs, balls, plungers and the shift rail lock guides. (6)—Loosen the locking screws and take out the shift rails and forks.

MAINSHAFT & MAIN DRIVE GEAR: (7)—Remove the main drive gear bearing retainer, tapping with a soft hammer if necessary to free it from the case. (8)—Tap the low and reverse gear toward the rear of the mainshaft sufficiently to enable the lock ring to be removed. (9)—Pull the mainshaft and bearing out of the rear of the case, using a suitable puller. (10)—Take out the low and reverse gear and the second and high shift sleeve from the case. (11)—Lift the main drive gear assembly out through the top.

NOTE—If the main drive gear is to be disassembled, use a suitable snap ring removing tool to take out the ring which retains the second speed gear to the main drive gear. With the snap ring removed, the gears, thrust washers and bearing may then be disassembled from the shaft—using a suitable puller to take off the bearing.

REVERSE GEARS, 1932-35: (12)—Remove the two reverse gear shaft screws, the cap, shift rail lock strap pivot and drive the shaft out from the inside of the case. The rotating shaft and gear assembly may now be lifted out.

For 1936-40 cars, simply remove the two screws and take the reverse gear and stationary shaft out of the

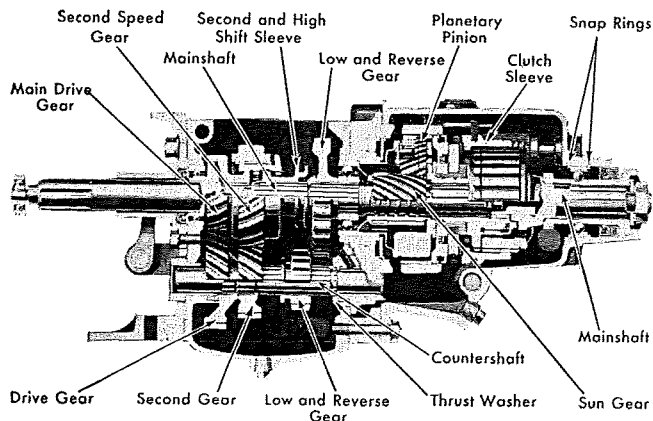


Fig. 59—Group No. 11 Transmission and Overdrive

case. Then lift the rotating shaft and gear assembly out of the case. **NOTE**—This assembly is serviced as a unit and parts are not supplied separately.

COUNTERSHAFT: (13)—Remove the cap screws which retain the countershaft rear bearing and remove the retainer, thrust washer and spacer. (14)—Use a suitable drift with its beveled edge between the high and second speed countershaft gears to separate these gears. (15)—Turn the countershaft slightly so that its splines butt against the splines of the drive gear. (16)—Then remove the countershaft second speed gear retainer. (17)—Drive the countershaft second speed gear forward, but not entirely off the shaft. (18)—Place the low and reverse shift lever in the reverse position. (19)—Shift the countershaft aside far enough to permit the shift lever to be placed in the neutral position. (20)—While holding the counter-gears together, take the shaft out through the rear. (21)—Remove the stud and take out the reverse intermediate lever. (22)—After loosening the set screw from the right side of the case, drive out the low and reverse shift fork shaft. (23)—Remove the cotter pin and nut from the bottom of the case and take out the reverse gear shifter parts.

REVERSE MECHANISM, ASSEMBLE: NOTE—Before installing the reverse shifter mechanism into the case, be sure that the beveled ends of the plunger and locating pins are highly polished and free from nicks or wear.

(1)—Install the reverse gear shifter lever, pick-up lever, plungers and plunger spring and place the locator pin in the lower lever. **CAUTION**—Be sure the beveled ends of the plunger and locator pins point to the bottom of the case. (2)—With these parts positioned properly, assemble in the case by inserting the fulcrum through the levers, being sure to place the copper gasket under the fulcrum nut. (3)—Install the reverse gear shifter in the lever. (4)—Replace the reverse shifter shaft and assemble its fork and lock securely in position with the set screw. (5)—After installing the low and reverse intermediate lever and stud, tighten the stud nut securely, being sure to place a copper washer under the nut.

COUNTERSHAFT, ASSEMBLE: (6) — Replace the countershaft expansion plugs and then take off the rear bushing cap. (7)—Install the countershaft thrust washer retainer ring into its groove on the shaft. (8)—Assemble the low and reverse gear. (9)—Replace the intermediate gear retainer.

(10)—On 1932-36 and early 1937, replace the intermediate gear on the shaft so that the front end of the gear is flush with the ends of the countershaft splines.

(11)—On late 1937 and all 1938-40, the intermediate gear is pressed on the shaft until the gear hub is over the retainer; then install the second gear retainer.

(12)—On all models, install the drive gear and front thrust washer. (13)—Place the low and reverse shifter lever in the straight up (neutral) position. (14)—Hold the three countergears together and install the assembly into the case. (15)—Shift the lever into its reverse position by moving it to the front of the case and enter the low and reverse gear into its fork.

(16)—On 1932-36 and early 1937 units, align the countershaft drive gear so that the splines of the shaft are entered in the hub, then drive the shaft forward until the intermediate gear hub is over the retainer.

(17)—On late 1937 and all 1938-40 cars, after the countershaft splines are entered into the hub, drive the shaft forward until the drive gear hub is over the retainer.

(18)—On all cars, install the countershaft rear spacer with its oil groove facing to the rear, then replace the bronze thrust washer on the front end of the rear bushing cap. (19)—Install the rear cap and thrust washer and insert enough shims between the bushing and the case to obtain from .005" to .009" end play; then tighten the cap securely.

REVERSE GEARS, ASSEMBLE: NOTE — On 1932-35 transmissions, install the sliding gear on the rotating shaft with the shift fork collar to the rear. For 1936 units, the collar should be toward the front.

(20)—Install the reverse rotating shaft stationary gear assembly and gear, entering the sliding gear collar on the reverse gear shifter.

NOTE—On 1932-35 cars, replace the stationary shaft in position and secure it with the dowel screw, then replace the reverse gear shaft cap, gasket and screws.

On 1936-40 units, first secure the stationary shaft in the cap with a dowel pin, then install it securely in the case.

MAINSHAFT & MAIN DRIVE GEAR, ASSEMBLE: (21)—Drive the main drive gear bearing in position on the gear. (22)—Replace the mainshaft needle bearing retaining ring. (23)—Assemble the main drive gear and mainshaft second gear. (24)—Place the thrust washer in the rear of the second gear. (25)—Install the second gear thrust washer on the main drive gear ahead of the bearing journal. (26)—Enter the main drive gear into the second gear and install the front thrust washer, with its babbitt face downward. (27)—Center the retainer ring so that its gap is $\frac{1}{4}$ turn away from the openings in the second gear. (28)—Force the second gear thrust washer retainer into the groove. (29)—Install the seven thrust balls and 26 needle bearings, using grease to hold them in position. (30)—Insert the main drive gear through the top of the case. (31)—Place the bearing on the rear of the mainshaft about one inch from the rear.

(32)—Install the mainshaft through the rear of the case, then replace the low and reverse gear and the second and high shift sleeve, with the shift collar to the rear. (33)—Replace the low and reverse gear retainer in its groove on the mainshaft, using grease to hold its parts in position. (34)—Hold the mainshaft against the thrust balls and drive the mainshaft rear bearing in place—which will, at the same time, drive the low and reverse gear forward to cover the retainer. (35)—Replace the speedometer drive gear. (36)—Install the companion flange, being sure to tighten the cap screw securely to prevent the speedometer gear from slipping.

NOTE—When replacing the rear bearing retainer, install sufficient shims between the retainer and the transmission case to obtain from .008" to .012" end play in the mainshaft.

CAUTION—Before tightening the retainer, make sure that the oil seal is in good condition.

SHIFTER MECHANISM, ASSEMBLE: (37)—Insert the second and high shift fork and install the rail through the case and fork. (38)—Replace the interlock plunger. (39)—Install the low and reverse shifter assembly and rail. (40)—Replace the balls, springs and plungers. (41)—Install the lock rod guides and caps, using enough shims between the rod guides and transmission case to obtain a clearance of .005" between the end of the plungers and the lock rod link. (42)—Insert the lock rod links in the guides and install cotter pins in the holes at the top.

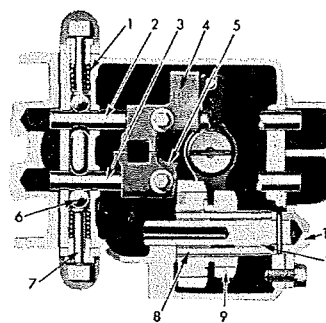


Fig. 60—Group No. 11
Shift Mechanism
Top View

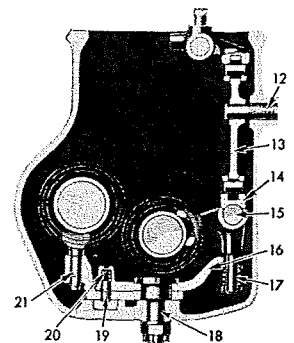


Fig. 61—Group No. 11
Shift Mechanism
Rear View

- | | |
|------------------------------------|---------------------------------|
| 1—Lock ball spring | 12—Intermediate lever stud |
| 2—Low and reverse shift rail | 13—Intermediate lever |
| 3—Second and high shift rail | 14—Shift fork assembly |
| 4—Low and reverse shifter ass'y | 15—Shift fork shaft |
| 5—Second and high shift fork | 16—Shifter pick-up lever |
| 6—Lock ball | 17—Shift fork spring |
| 7—Lock ball spring cap | 18—Shift lever fulcrum |
| 8—Stationary reverse gear retainer | 19—Shift lever locator pin |
| 9—Sliding reverse gear | 20—Pick-up lever plunger spring |
| 10—Reverse gear shaft cap | 21—Reverse gear shifter |
| 11—Reverse rotating shaft bushing | |

TRANSMISSION, OVERHAUL

(43)—Replace clutch housing. (44)—Insert the threaded ends of the lock rods into the holes of the clutch throwout bearing and locking levers. (45)—Assemble the sleeves, springs and washers on the threaded ends of the links and replace the nuts securely. (46)—Connect the upper ends of the rods to the lock rod links and install the clevis pins. (47)—Replace drain plug and fill the transmission with lubricant to the height of the filler plug hole. (48)—Install the transmission cover.

OVERDRIVE, OVERHAUL, 1940

For service on this unit, see GROUP No. 7. And if necessary to replace the mainshaft, follow instructions as already described above.

GROUP No. 12

Fig. 62

CHEVROLET 1933-36 STANDARD MODELS

DISASSEMBLE

MAINSHAFT: (1)—Take off the transmission cover assembly. (2)—Remove the gear shift guide plate and fork assembly. (3)—Lock the transmission in two gears to prevent the mainshaft from turning. (4)—Remove the speedometer driven gear and shaft. (5)—Remove the universal joint ball. (6)—Unscrew the bolt which fastens the universal joint to the mainshaft and pull off the joint. (7)—Unfasten the ball retainer and remove the retainer, mainshaft and sliding clutch sleeve from the transmission. (8)—Take the sliding clutch sleeve from the mainshaft. (9)—Press the mainshaft out of the rear bearing, supporting the bearing with the second speed gear to avoid damaging the bearing race. (10)—Slip the second speed gear and thrust washer from the mainshaft. (11)—Expand the snap ring and tap the mainshaft rear bearing out of the retainer. (12)—Slide the first speed gear from the mainshaft.

MAIN DRIVE GEAR: (13)—Remove the pilot bearing from the inside of the main drive gear. (14)—Unfasten the bearing retainer and take out the gear and bearing assembly. (15)—Release the snap ring and press the bearing from the gear.

COUNTERSHAFT: (16)—Drive the shaft out from the front to the rear and lift out the countergear assembly.

REVERSE IDLER: (17)—Drive out the expansion plugs, remove the idler shaft lock screw and drive the shaft out from either end; then lift out the gear.

INSPECTION: Check the counter and idler gear bushings for wear by using a new shaft and a narrow feeler gauge. The clearance between the bushing and the shaft should be .002" to .004". If the clearance exceeds this amount, the gear and bushing assembly should be replaced. The bushings are not serviced separately as they are a pressed fit and accurately bored for proper alignment.

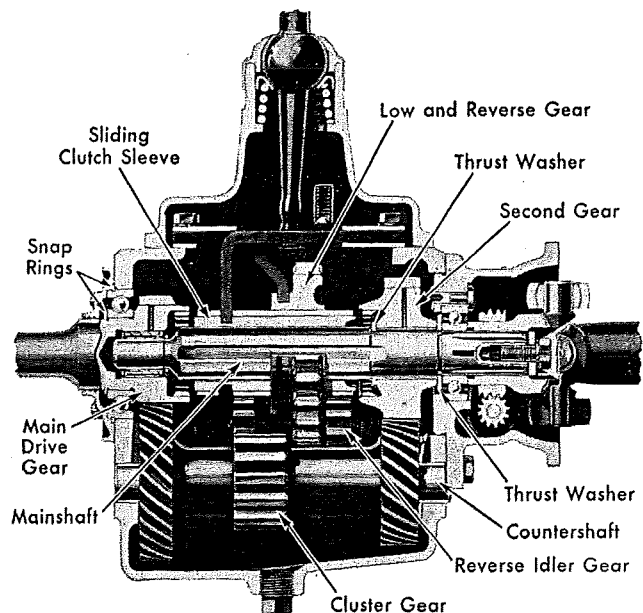


Fig. 62—Group No. 12 Transmission

Wash the bearings in clean gasoline and oil the balls; then check the balls for cracks or roughness. When installing the mainshaft and second gear assembly into the universal ball retainer, it is important that the inner race of the bearing be supported to prevent damage to the bearing. This precaution also applies to the main drive gear bearing when installing the gear and its snap ring.

ASSEMBLE

(1)—Expand the snap ring and tap the mainshaft rear bearing into the retainer. (2)—Assemble the second speed gear front thrust washer and retainer to the mainshaft. (3)—Install the second gear and rear thrust washer on the mainshaft with the grooves in the washer facing the gear. (4)—Replace the mainshaft rear bearing, using care not to damage the bearing. (5)—Install the sliding clutch sleeve on the mainshaft.

(6)—Assemble the idler gear into the case with its chamfered end to the rear. (7)—Replace the idler shaft, lining up the hole in the shaft with the screw hole in the case. (8)—Tighten the locking screw and drive in the expansion plugs.

(9)—To install the countergear, dip the thrust washer in heavy oil and assemble it to the rear end of the case, lining up its raised part with the cut in the case. (10)—Place the countergear in position and drive the shaft in from the rear.

(11)—Replace the main drive gear and retainer to the case, driving on the outer race of the bearing and not the gear. **NOTE**—Driving on the gear may push the gear through the bearing and result in a noisy bearing. (12)—Apply transmission lubricant to the

pilot bearing and place it in the pocket of the main drive gear. (13)—Hold the first speed gear in position and install the mainshaft assembly into the case and through the first speed gear. **CAUTION**—Be sure the fork channel of the first speed gear is to the front. (14)—Bolt the mainshaft rear bearing retainer securely in place. (15)—Replace the universal joint and the joint ball and collar. (16)—Set the gears in neutral and install the shift guide plate and fork assembly. (17)—Replace the transmission cover.

GROUP No. 13

Fig. 63

CHEVROLET 1933-36 MASTER MODELS AND ½ TON TRUCKS 1933-35 PONTIAC

DISASSEMBLE: (1)—Take off the transmission cover assembly and lock the transmission in two gears to prevent the mainshaft from turning. (2)—Remove the speedometer driven gear. (3)—Disconnect the universal joint front yoke with its ring and trunnion bearings. (4)—Unfasten the universal joint ball retainer and turn it to clear the countershaft. (5)—Drive the countershaft out rearward. (6)—Remove the universal ball retainer with the second speed gear and clutch sleeve as an assembly. (7)—Lift out the first speed gear, mainshaft pilot bearing and the front synchronizing drum with its spring through the top. (8)—Unscrew the main drive gear bearing retainer from the case and remove the retainer and main drive gear assembly. (9)—Drive out the reverse idler gear expansion plugs, remove the lock screw and drive the idler shaft out rearward. (10)—Lift out the idler gear and the countergear cluster assembly.

MAINSHAFT, DISASSEMBLE: (a) — Remove the clutch sleeve from the shaft and press the mainshaft out of the rear bearing retainer. (b)—Expand the snap ring which retains the rear bearing in the retainer and take out the bearing. (c)—Slip the second speed gear and thrust washers from the mainshaft. (d)—With a suitable spreader tool, remove the synchronizer spring from the mainshaft. (e)—Take off the second speed synchronizing drum, thrust washer retainer and thrust washer.

INSPECTION: Check the countergear, idler gear and second speed gear bushings for wear by using a new shaft and a narrow feeler gauge. The clearance between the bushing and its shaft should be from .002" to .004". If the clearance exceeds this amount, it is recommended that the bushing and gear assembly be replaced to assure proper alignment of the bushings with their gears as well as proper mesh of the gears. However, if the bushings are replaced, they must be line reamed to size. When replacing countershaft bushings, be sure to install the longer bushing in the rear of the gear.

Inspect all gears for chipped, cracked or worn teeth. Check the clutch sleeve splines with the internal teeth

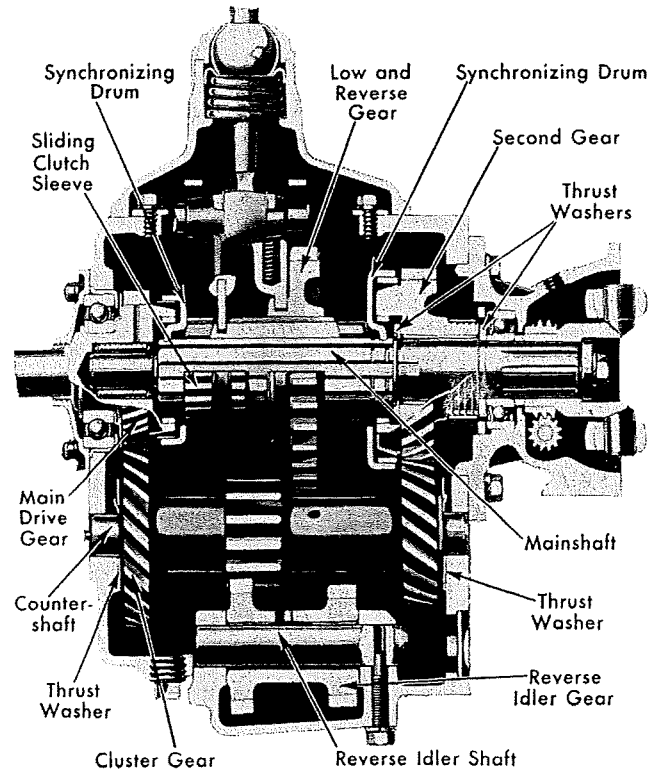


Fig. 63—Group No. 13 Transmission

of the main drive gear; the clutch sleeve splines on the mainshaft; the clutch sleeve splines with the internal teeth of the second speed, and the clutch sleeve splines with the splines on the first speed gear. Inspect the second speed gear thrust washer for wear. See that the shift fork shafts are a free fit in the notches of the shafts.

ASSEMBLE: (1)—Hold the reverse idler in position and install the idler shaft in through the rear of the case, lining up the hole in the shaft with the hole in the case; then install the lock screw securely. (2)—Dip the countershaft thrust washers in heavy oil and assemble them to the case, lining up the raised part of the washers with the cut-out in the case. (3)—Install the countergear into the case, allowing it to rest on the bottom.

(4)—Install the oil slinger and bearing on the main drive gear, supporting the bearing on its inner race during the process to avoid damaging the bearing. (5)—Replace the bearing lock ring, and install the main drive gear assembly and retainer to the transmission. **NOTE**—When installing this assembly, tap the outer race of the bearing and not the gear, as the gear is apt to go through the bearing, causing the oil slinger to become loose and cause a rattle. The main drive gear bearing is marked "Top" and should be so installed. (6)—Dip the mainshaft pilot bearing in transmission lubricant and insert it in the pocket of the main drive gear.

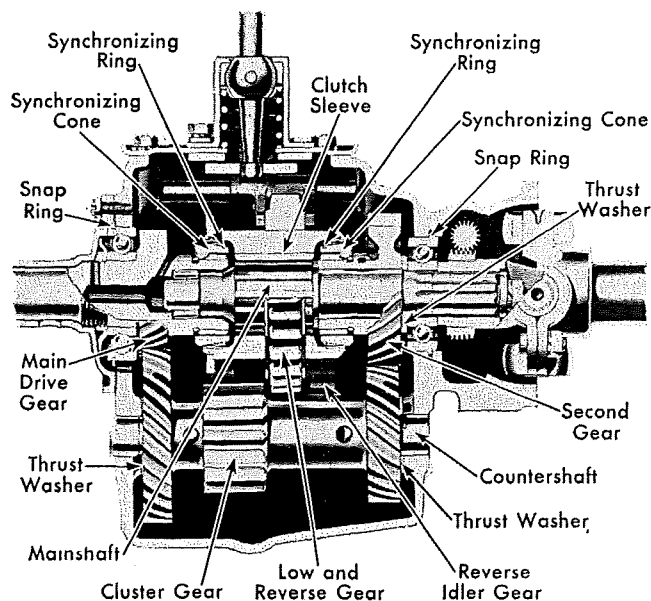


Fig. 64—Group No. 14 Transmission

(7)—Assemble the front synchronizer drum to the front cone. (8)—Place the second speed gear thrust washer on the mainshaft and lock it in position with its retainer. (9)—Install the rear synchronizer drum on the mainshaft. NOTE—Measure the dimension of the rear synchronizing spring, using a micrometer across the three slots, and note the size. This dimension determines the proper clearance between the drum and the cone.

(10)—Install the rear synchronizing spring on the mainshaft by expanding it just enough so it slips over the shaft. (11)—Assemble the second speed gear to the mainshaft and drum. (12)—Measure the clearance between the spring and the shoulder on the mainshaft by pressing the second speed gear against its thrust washer and the drum against the cone. This clearance should not be less than .025" nor more than .035". If not within these limits, change the springs as they are available in several thicknesses.

(13)—Install the mainshaft rear bearing in the retainer with its oil seal side toward the transmission. (14)—Replace the oil slinger and bearing lock ring, being sure that the ring seats in the groove in the transmission case. (15)—Install the rear thrust washer to the inside of the oil slinger with the grooves facing the second speed gear. (16)—Insert the mainshaft into the rear bearing and retainer. CAUTION—Be sure the legs on the synchronizing drum line up with the slots in the rear synchronizing spring.

(17)—Replace the clutch sleeve on the mainshaft, lining up the slots in the sleeve with the legs of the drum. NOTE—Measure the dimension of the front synchronizing spring in the same manner as described for the rear spring and note the size. (18)—Install this spring on the mainshaft, being sure that the prongs of the spring face the sleeve. (19)—Hold the first speed gear in position in the case and insert the mainshaft

and rear bearing retainer assembly into the transmission and through the first speed gear. NOTE—Be sure the fork channel of the gear is toward the front, and that the notches in the sleeve line up with the front drum. (20)—Fasten the rear retainer securely to the transmission case. (21)—Drive in the idler gear shaft expansion plugs.

NOTE—Check the clearance between the front synchronizer spring and the shoulder of the mainshaft which should not be less than .025" nor more than .035". If not within these limits, compute the difference between this clearance and the micrometer measurements previously taken and change the springs accordingly. It is only necessary to remove the main drive gear to change the front spring.

(22)—Align the countergear and thrust washers with the holes in the case and drive the countergear in through the rear. (23)—Replace the universal yoke. (24)—Install the transmission cover.

GROUP No. 14

Fig. 64

CHEVROLET 1937-39

ALL PASSENGER CARS

CHEVROLET 1937, ½ TON TRUCKS

CHEVROLET 1938, ½, ¾ AND

1 TON TRUCKS

CHEVROLET 1939, ½, ¾ AND SPECIAL ¾ TON TRUCKS

DISASSEMBLE

SHIFTER MECHANISM: (1)—On 1939 cars with steering gearshift, remove the transmission cover and shifter assembly. For cars with floor-type shift, if the shift mechanism is to be disassembled, remove two opposite screws from the lever housing and replace with two longer screws so that they all may be removed evenly to relieve the tension on the lever spring before taking off the retainer. NOTE—The two front screws are special in that they lock the shifter shafts in the transmission case. (2)—After removing the interlock, drive the shafts from the case rearward. NOTE—These shafts are .003" larger in diameter where they fit into the front of the case. (3)—Remove the shifter yokes, lock balls and springs.

MAIN DRIVE GEAR: (4)—Lock the transmission in two gears, being careful not to damage the wedge angles on the synchronizing clutch mechanism. (5)—Disconnect the universal joint and slide the joint and spacer from the mainshaft. (6)—Remove the main drive gear bearing retainer, but before removing the gear, mark the relationship between the clutch gear and the second speed gear with their rings so they may be assembled in the same relative position. (7)—Using a suitable puller, screw the threaded sleeve of the puller onto the shaft in a counter-clockwise direction and take off the main gear and bearing. (8)—Remove the needle bearings from the pocket of the main drive gear.

NOTE—To disassemble the main drive gear, take off the retaining nut and oil slinger—which is a one-piece assembly with a left-hand thread and is locked in place by being staked into a hole provided for that purpose. Use a press to remove the bearing from the shaft.

For 1938-39 cars and trucks, a new main drive gear bearing retainer is available for service for use on vehicles subjected to extreme service.

MAINSHAFT: (9)—Turn the front synchronizer ring so that one lug lines up directly between a land and a spline on the mainshaft. (10)—Force the mainshaft out of the rear bearing and remove the shaft out through the front of the case. (11)—Shift the second gear into the synchronizer clutch sleeve and take out the sleeve, second speed gear and the first and reverse sliding gear as an assembly.

NOTE—To disassemble the clutch sleeve, remove the sliding gears and turn the synchronizing ring in the clutch sleeve until the ends of the ring retainers can be seen through the slot in the sleeve. Then expand the retainer into the counterbore in the sleeve and slip out the ring.

COUNTERSHAFT: (12)—Before removing the countergears, expand the mainshaft rear bearing lock ring to raise it from the bearing groove. (13)—Tap lightly on the outer race of the bearing and remove it from the inside of the case. (14)—Drive the countershaft out through the front and lift out the cluster gear and thrust washers.

REVERSE IDLER: (15)—Drive out the reverse idler gear expansion plug from the inside of the case. (16)—Drive the reverse idler shaft lock pin into the shaft, being careful not to turn the shaft as the lock pin may drop down between the idler shaft bushings. (17)—Remove the shaft and lift out the gear and thrust washers.

INSPECTION: See that the synchronizing cones are not loose in the clutch sleeve. If the cones are damaged, it will be necessary to replace the clutch sleeve assembly and both synchronizing rings. The rings must be smooth and should not rock in the cones, as excessive rocking affects proper synchronizing of the gears when shifting.

Normally, it should not be necessary to replace the synchronizer energizing springs. However, should this be required, the spring is assembled in its groove with its offset end between the second and third clutch teeth of any bank of teeth—which will prevent the spring from turning in its groove. Whenever removed, these springs should always be replaced with new ones, and when doing so, care should be exercised to prevent distortion when expanding the spring over the clutch teeth.

The countergear and idler gear bushings are not serviced separately as they are a pressed fit and accurately bored to assure proper alignment with their

gears as well as proper mesh of the gears. If the clearance between these bushings and their shafts is in excess of .004", the gear and bushing assembly should be replaced.

ASSEMBLE

REVERSE IDLER: (1)—Hold the idler gear in position in the case and install the idler shaft, being sure that the lock pin hole in the shaft lines up with the holes in the case. (2)—Using a new lock pin, drive it in about $\frac{1}{16}$ " below the case and peen the hole slightly to provide a tight fit and to prevent an oil leak. (3)—Install the idler shaft expansion plug.

COUNTERSHAFT: (4)—Place the countergear assembly into the case. (5)—Dip the countershaft thrust washers in transmission lubricant and place them in their proper position at each end of the gear. (6)—Use a suitable tool to pick up and align the gear and thrust washers with the holes in the case and drive the countershaft in from the front. **CAUTION**—The flat on the front end of the shaft should be in a horizontal position and facing upward, otherwise it will not engage the clutch housing. The step on this end of the shaft should be flush with the front face of the case or about $\frac{1}{16}$ " below the face—to maintain proper transmission alignment.

CLUTCH SLEEVE: (7)—Install the ring retainers in the counterbores in the ends of the clutch sleeve. (8)—Expand the ring retainer and at the same time, hold it flush with the back face of the cone. Install the rings, being sure the retainers are properly seated in the grooves. (10)—Slip the first and reverse sliding gear on the sleeve. (11)—Install the second speed gear at the rear end of the sleeve, meshing the clutch teeth on the gear with those in the sleeve. **CAUTION**—Be sure that the synchronizing ring lugs engage the clutch teeth on the second speed gear in their original position by aligning the marks which were made on these parts before they were disassembled. (12)—Coat the grooved side of the second speed gear thrust washer with gear oil and place it on the back of the gear. **NOTE**—Line up one lug on the front synchronizing ring with an internal spline tooth in the clutch sleeve. If this precaution is not taken, the clutch sleeve splines and the mainshaft splines will be burred when installing the mainshaft.

MAINSHAFT: (13)—When installing the mainshaft, lubricate the portion upon which the second speed gear fits. The proper seating of the mainshaft shoulder against the inner race of the rear bearing can be checked by the end play of the second speed gear which should be .010".

SHIFTER MECHANISM: (14)—Install the shift yoke lock balls and springs in the transmission case. (15)—Install the shift yokes, placing the first and reverse yoke in its sliding gear channel and the second and high yoke over the ring on the sliding clutch sleeve. (16)—Install the shift shafts from the front—the longer one being for first and reverse—then line

TRANSMISSION, OVERHAUL

up the lock holes in the shafts with the cover holes in the top of the case. (17)—Place the shifter interlocks in the slots in the yokes with the pins pointing upward and with the hole nearer to the second and high speed shift shaft. (18)—Assemble the cover assembly to the case, being sure to use the two special cap screws at the front.

GROUP No. 15

Figs. 65, 66, 67, 68

CHEVROLET 1940-42

ALL PASSENGER CARS

CHEVROLET 1940-42, $\frac{1}{2}$, $\frac{3}{4}$ AND SPECIAL $\frac{3}{4}$ TON TRUCKS

DISASSEMBLE

NOTE—See the TROUBLE DIAGNOSIS chapter in Group No. 19 as a guide to determine the cause of transmission defects.

MAIN DRIVE GEAR: (1)—Lock the transmission in two gears, being careful not to damage the wedge angles on the synchronizing clutch mechanism. (2)—Disconnect the universal joint and slide the joint and spacer from the mainshaft. (3)—Remove the main drive gear bearing retainer. (4)—Using a suitable puller, screw the threaded sleeve of the puller onto the shaft in a counter-clockwise direction and take off the main drive gear and bearing. (5)—Remove the needle bearings from the pocket of the main drive gear.

NOTE—To disassemble the main drive gear, take off the retaining nut and oil slinger—which is a one-piece assembly with a left-hand thread and is locked in place by being staked into a hole provided for that purpose. Use a press to remove the bearing from the shaft.

A new main drive gear bearing retainer is available for service for use on vehicles subjected to extreme service.

MAINSHAFT: (6)—Place the front synchronizer ring in a position so that its lugs line up with the slots in the mainshaft helical spline. (7)—Force the mainshaft out of the rear bearing and remove the shaft out through the front of the case. (8)—Shift the second speed gear into the synchronizer clutch sleeve and take out the sleeve, second speed gear and the first and reverse sliding gear as an assembly.

NOTE—To disassemble the clutch sleeve, remove the sliding gears and turn the synchronizing ring in the clutch sleeve until the ends of the ring retainers can be seen through the slot in the sleeve. Then expand the retainer into the counterbore in the sleeve and slip out the ring.

COUNTERSHAFT: (9)—Before removing the countergears, expand the mainshaft rear bearing lock ring to raise it from the bearing groove. (10)—Tap lightly on the outer race of the bearing and remove it from the inside of the case. (11)—Drive the counter-

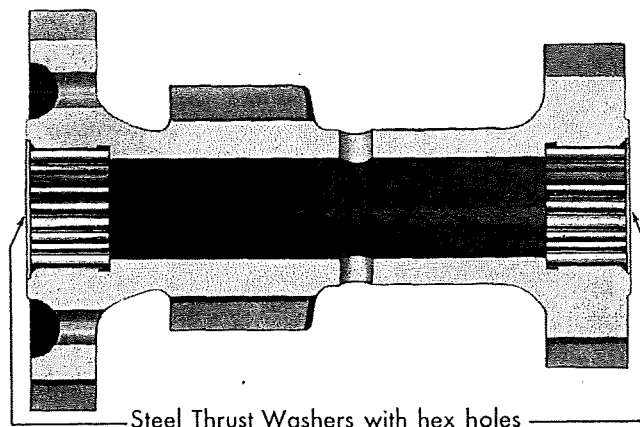


Fig. 65—Group No. 15 Needle Bearing Cluster Gear

shaft out through the front and lift out the cluster gear, thrust washers and needle bearings (if equipped).

REVERSE IDLER: (12)—Drive out the reverse idler gear expansion plug from the inside of the case. (13)—Drive the reverse idler shaft lock pin into the shaft, being careful not to turn the shaft as the lock pin may drop down between the idler shaft bushings. (14)—Remove the shaft and lift out the gear and thrust washers.

INSPECTION: See that the synchronizing cones are not loose in the clutch sleeve. If the cones are damaged, it will be necessary to replace the clutch sleeve assembly and both synchronizing rings. The rings must be smooth and should not rock in the cones, as excessive rocking affects proper synchronizing of the gears when shifting.

Normally, it should not be necessary to replace the synchronizer energizing springs. However, should this be required, the spring is assembled in its groove with its offset end between the fourth and fifth clutch teeth of either bank of teeth—which will prevent the spring from turning in its groove. Whenever removed, these springs should always be replaced with new ones, and when doing so, care should be exercised to prevent distortion when expanding the spring over the clutch teeth.

The countergear and idler gear bushings (if equipped) are not serviced separately as they are a pressed fit and accurately bored to assure proper alignment with their gears as well as proper mesh of the gears. If the clearance between these bushings and their shafts is in excess of .004", the gear and bushing assembly should be replaced.

ASSEMBLE

REVERSE IDLER: See Fig. 67. (1)—Hold the idler gear in position in the case and install the idler shaft, being sure that the lock pin hole in the shaft lines up with the hole in the case. (2)—Using a new

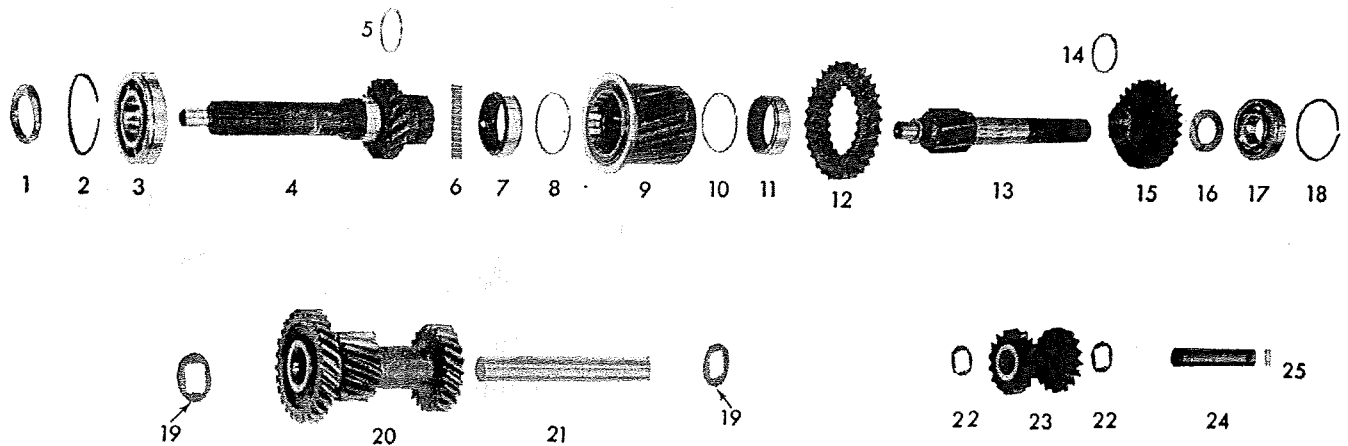


Fig. 66—Group No. 15 Transmission

1—Bearing retainer nut
2—Bearing snap ring
3—Bearing
4—Main drive gear
5—Energizing spring
6—Mainshaft pilot bearing rollers
7—Synchronizing ring

8—Ring retainer
9—Clutch sleeve
10—Ring retainer
11—Synchronizing ring
12—Low and reverse gear
13—Mainshaft
14—Energizing spring

15—Second gear
16—Thrust washer
17—Bearing
18—Snap ring
19—Thrust washers
20—Roller bearings
21—Cluster gear

22—Countershaft
23—Roller bearings
24—Thrust washers
25—Thrust washer
26—Reverse idler gear
27—Thrust washer
28—Reverse idler shaft
29—Lock pin

lock pin, drive it in about $\frac{1}{16}$ " below the case and peen the hole slightly to provide a tight fit and to prevent an oil leak. (3)—Install the idler shaft expansion plug.

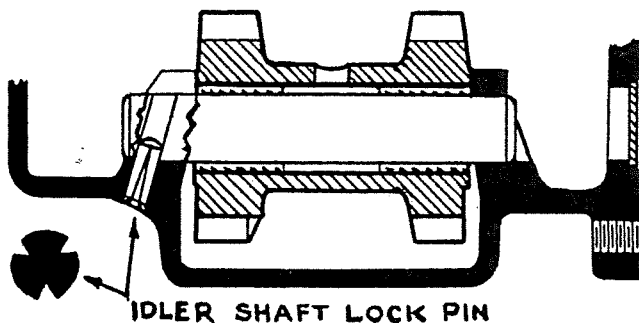


Fig. 67—Group No. 15
Idler Shaft Locks Pin in Position

COUNTERSHAFT: (4) — Place the countershaft assembly into the case. (5)—Dip the countershaft thrust washers in transmission lubricant and place them in their proper position at each end of the gear. (6)—Use a suitable tool to pick up and align the gear and thrust washers with the holes in the case and drive the countershaft in from the front. **CAUTION**—The flat on the front end of the shaft should be in a horizontal position and facing upward, otherwise it will not engage the clutch housing. The step on this end of the shaft should be flush with the front face of the case or about $\frac{1}{64}$ " below the face—to maintain proper transmission alignment.

NOTE—A countergear cluster equipped with needle bearings instead of bushings is available for replacement. To install this assembly, apply a liberal amount

of cup grease at each end of the countergear where the needle bearings are to be inserted. With a shaft, or arbor—which is not any longer than the length of the countergear and thrust washers combined—installed in place of the regular countershaft to hold the bearings in place, install the assembly into the case and drive the dummy shaft out with the regular countershaft.

CLUTCH SLEEVE: (7)—Install the ring retainers in the counterbores in the ends of the clutch sleeve. (8)—Expand the ring retainer and at the same time, hold it flush with the back face of the cone. (9)—Install the rings, being sure the retainers are properly seated in the grooves. Slip the first and reverse sliding gear on the sleeve. (11)—Install the second speed gear at the rear end of the sleeve, meshing the clutch teeth on the gear with those in the sleeve. (12)—Coat the grooved side of the second speed gear thrust washer with gear oil and place it on the back of the gear.

MAINSHAFT: (13)—When installing the mainshaft, lubricate the portion upon which the second speed gear fits. The proper seating of the mainshaft shoulder against the inner race of the rear bearing can be checked by the end play of the second speed gear which should be .010".

SHIFTER MECHANISM: Cars with steering column shift: (1)—Install the long shift fork on the guide bar with the fork end toward the nearest guide bar screw hole. **NOTE**—Be sure to line up one shift lock recess in the fork with the hole which is drilled through the guide bar. (2)—Place a ball and spring in the guide bar hole. (3)—Slide the other shift fork partly on the guide bar and assemble the other ball on the spring. (4)—Use a screwdriver to compress the

TRANSMISSION, OVERHAUL

spring until the ball is in the guide bar hole. (5)—With the spring still compressed, slide the fork over the ball and position both forks in their neutral position. (6)—Assemble the operating shaft to the cover and the anti-rattle spring and shift yoke lever to the bellcrank end of the operating shaft, then move the bellcrank over to the center of the yoke lever. (7)—Assemble the guide bar and fork assembly to the cover with the low and reverse fork toward the narrow side of the cover. NOTE—The bellcrank fits in the slot between the forks and the fork pins go into the slots in the ends of the shift yoke lever. (8)—Replace the cover, being sure that the low speed gear and the clutch sleeve are in neutral.

SHIFTER MECHANISM. Trucks: (1)—Install the shift fork lock balls and springs in the transmission case. (2)—Install the shift yokes, placing the first and reverse yoke in its sliding gear channel and the second and high yoke over the ring on the sliding clutch sleeve. (3)—Install the shift shafts from the front—the longer one being for first and reverse—then line up the lock holes in the shafts with the cover holes in the top of the case. (4)—Place the shifter interlocks in the slots in the yokes with the pins pointing upward and with the hole nearer to the second and high shift shaft. (5)—Assemble the cover to the case, being sure to use the two special cap screws at the front.

GROUP No. 16

Fig. 69

BUICK 1936-38, SERIES 60, 80 AND 90

NOTE—See the TROUBLE DIAGNOSIS chapter in Group No. 19 as a guide to determine the cause of transmission defects.

INSPECTION

NOTE—Remove the transmission cover and take out the shift rail detent balls and springs. Clean the transmission thoroughly and, before dismantling the transmission, check the following to determine the cause of failure.

(a)—Grasp the mainshaft to prevent it from turning and turn the main drive gear to make sure that it is free. (b)—Check the synchronizer unit to see that it does not bind on the mainshaft. (c)—Examine the three flat detent springs to see that they are not bent or broken and that they are positioned properly. (d)—The total synchronizer cone-to-cone engagement must have not less than $\frac{1}{8}$ " nor more than $\frac{3}{16}$ " end play; less than $\frac{1}{8}$ " end play may cause a drag between the friction cones, which produces a gear noise in neutral, while more than $\frac{3}{16}$ " end play may be the cause of a gear clash when shifting. (e)—Examine the shift forks to make sure they are tightened securely to the shift rails. (f)—See that the shift interlock plate in the cover operates properly. (g)—Shift forks which are bent produce hard shifting because they will not en-

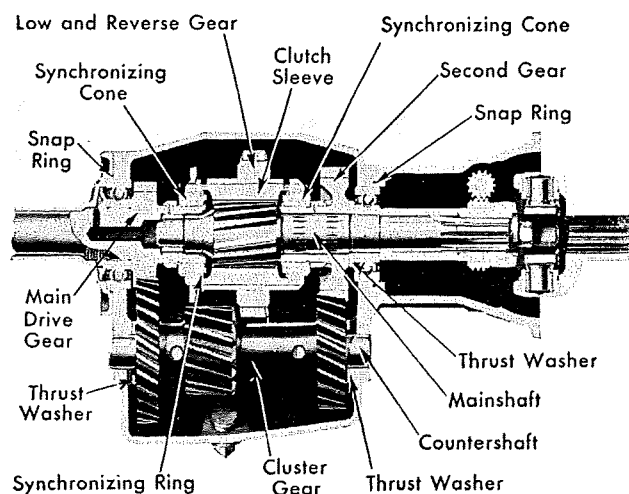


Fig. 68—Group No. 15 Transmission

gage the sliding clutch flange with equal pressure on both sides.

NOTE—If all the foregoing items are found to be correct, disassemble the transmission in the following manner.

DISASSEMBLE

(1)—Take off the universal ball and retainers. (2)—Remove the speedometer driven gear. (3)—Unscrew the bolt which fastens the universal joint to the mainshaft and use a puller, if necessary, to remove the joint. (4)—Unfasten the mainshaft rear bearing retainer from the transmission. (5)—Release the snap ring which retains the mainshaft rear bearing and tap the bearing from the shaft and out of the case. (6)—Shift the mainshaft to the rear and lift it out of the case by its front end. NOTE—Be sure to collect all the needle bearings from the pocket of the main drive gear on 1937-38 units. (7)—Unscrew the main drive gear bearing retainer from the case and slide it from the shaft. (8)—Expand the snap ring and remove it from the main drive gear bearing. (9)—Tap the gear and bearing assembly into the transmission and lift it out through the top. (10)—Unbolt the countershaft lock screw and drive the shaft out toward the rear. NOTE—For this operation, use a dummy shaft—or arbor—which is exactly the same length as the counter-gear and thrust washers combined to hold the needle bearings in position. (11)—Take out the reverse idler gear lock screw, tap the reverse idler shaft out through the rear and lift out the gear and thrust washers.

MAINSHAFT: To disassemble, remove the synchronizer unit and first and reverse sliding gear from the mainshaft. Release the snap ring from the front of the second speed gear and slide the gear from the shaft. NOTE—The second speed gear on 1936 transmissions is equipped with needle bearings which can

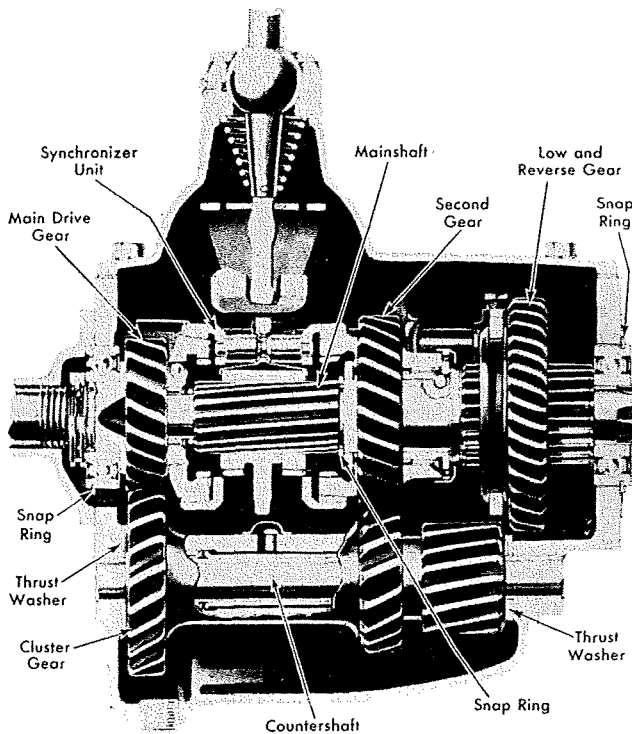


Fig. 69—Group No. 16 Transmission

be removed by taking off the snap ring from the rear of the gear after which, the needle bearings and sleeves may be withdrawn.

ASSEMBLE

REVERSE IDLER: (1)—Insert the idler shaft partly into the case, being sure that the lock screw hole is toward the front. (2)—Place the rear thrust washer on the shaft, then the idler gear and the front thrust washer, after which, tap the shaft all the way into position. (3)—Line up the screw hole in the shaft with the hole in the case and install the lock screw securely.

COUNTERSHAFT: (4)—Insert the spacer into the gear. (5)—Place the dummy shaft into the gear and install the needle bearings, using a liberal quantity of grease to hold them in place. (6)—Place a bronze thrust washer at each end of the gear and a steel thrust washer at the rear end of the assembly, being sure that the steel washer is between the case and the bronze washer. (7)—Place the assembly into the case and drive out the dummy shaft by installing the regular countershaft. (8)—Line up the lock screw hole in the rear of the shaft with the hole in the case and install the lock screw securely.

MAIN DRIVE GEAR: (9)—Tap the main drive gear and bearing assembly into position from the inside of the case and lock it in place with a new snap ring. (10)—Replace the main drive gear bearing retainer and

tighten it to the case securely. (11)—Install the mainshaft front pilot bearing into the pocket of the main drive gear. **NOTE**—On 1937-38 units, place the needle bearings in position, using cup grease to hold them in place.

MAINSHAFT: **NOTE**—Except for the flat detent springs, service on the synchronizer assembly is by replacement only. To give best results when synchronizing, the bronze cones should show the heaviest contact on their large diameters. Be sure these cones are not scored and that the oil grooves are clean.

(12)—Install the second speed gear on the mainshaft and lock it in place with a new snap ring. (13)—Replace the first and reverse sliding gear and the synchronizer assembly on the shaft. (14)—Place the assembly into the case and insert its front end into the main drive gear, being sure that all the mainshaft pilot bearing rollers are in position. (15)—Install the mainshaft rear bearing and lock it in place with a new snap ring. (16)—Replace the rear bearing retainer and tighten the retaining screws securely. (17)—Slip the universal joint over the end of the mainshaft and install the locking screw and washer. (18)—Install the speedometer driven gear and complete the assembly by installing the universal ball and its retainers. (19)—Replace the transmission cover assembly and check the operation of the unit in all gears.

GROUP No. 17

Fig. 70

BUICK 1939-42, SERIES 60, 70, 80 AND 90

NOTE—See the TROUBLE DIAGNOSIS chapter in Group No. 19 as a guide to determine the cause of transmission defects.

INSPECTION

NOTE—Remove the transmission cover and clean the transmission thoroughly. Before dismantling the unit, check the following to determine the cause of failure.

(a)—Grasp the mainshaft to prevent it from turning and turn the main drive gear to make sure it is free. (b)—Check the synchronizer unit to see that it does not bind on the mainshaft. (c)—Examine the three flat detent springs to be sure they are not bent or broken and that they are positioned properly. (d)—The total synchronizer cone-to-cone engagement must have not less than $\frac{1}{8}$ " nor more than $\frac{3}{16}$ " end play; less than $\frac{1}{8}$ " end play may cause a drag between the friction cones, which produces a gear noise in neutral, while more than $\frac{3}{16}$ " end play may be the cause of a gear clash when shifting. (e)—Examine the shift forks and selector shaft cams to see that they are tightened securely to the shift rails. (f)—Shift forks which are bent produce hard shifting because they will not engage the sliding clutch flange with equal pressure on both sides.

TRANSMISSION, OVERHAUL

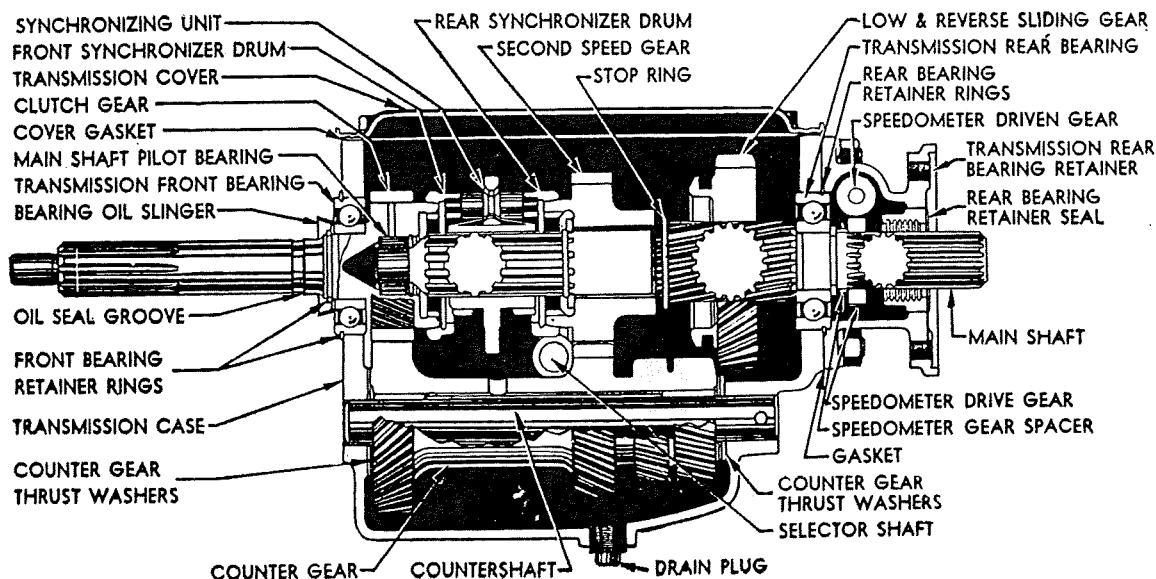


Fig. 70—Group No. 17 Transmission

NOTE—If the foregoing items are found to be correct, disassemble the transmission in the following manner.

DISASSEMBLE

(1)—Remove the shift shafts, rails, forks, springs and balls. (2)—Take off the universal ball and retainers. (3)—Unscrew the bolt which fastens the universal joint to the mainshaft and use a puller, if necessary, to remove the joint. (4)—Unfasten the mainshaft rear bearing retainer from the transmission. (5)—Release the snap ring which retains the mainshaft rear bearing and tap the bearing from the shaft and out of the case. (6)—Shift the mainshaft to the rear and lift it out of the case by its front end. CAUTION—Be sure to collect all the needle bearings from the pocket of the main drive gear.

NOTE—If the shift forks have not been removed, the mainshaft can be taken out in the following manner: (a)—Remove both shift fork lock screws. (b)—Shift the synchronizer assembly in the high gear position. (c)—Move the mainshaft back until the front end is clear of the front pilot bearing. (d)—Lift the mainshaft up and to the left until the second and high shift fork clears the collar on the synchronizer and move the fork toward the rear. (e)—Shift the mainshaft to the right to disengage the shift fork from the first and reverse sliding gear, then move this fork forward. (f)—Remove the synchronizer assembly. (g)—Expand the second speed gear snap ring and slide the second speed gear forward and remove the low gear stop ring. (h)—Grasp the second and low gears and remove the mainshaft and rear bearing out through the rear of the case.

NOTE—Before the main drive gear can be removed, the countershaft will have to be driven out, allowing the cluster gear to lie in the bottom of the case.

(7)—Use a dummy shaft—or arbor—which is exactly the same length as the cluster gear and thrust washers combined, to drive out the countershaft to the rear, allowing the gear, thrust washers and needle bearing assembly to lie in the bottom of the case. (8)—Unscrew the main drive gear bearing from the case and slide it from the shaft. (9)—Expand the snap ring and remove it from the main drive gear bearing. (10)—Tap the gear and bearing assembly into the transmission and lift it out through the top. (11)—Drive the reverse idler shaft locking pin into the shaft as far as possible, drive out the shaft toward the rear and lift out the gear and thrust washers.

ASSEMBLE

REVERSE IDLER: (1)—Drive out the old lock pin from the shaft. (2)—Insert the idler shaft partly into the case, being sure that the lock pin hole is to the front. (3)—Place the rear thrust washer on the shaft, then the idler gear and the front thrust washer. (4)—Tap the shaft all the way into position. (5)—Line up the lock pin hole in the shaft with the hole in the case and install a new lock pin. NOTE—The pin is correctly installed when the outer end is from $\frac{5}{8}$ " to $\frac{3}{4}$ " past the flush surface of the transmission case boss.

MAIN DRIVE GEAR: (6)—Place the countergear assembly into the bottom of the case, but do not install the countershaft until after the main drive gear is in position. (7)—Tap the main drive gear and bearing assembly into place from the inside of the case and lock

it with a new snap ring. (8)—Replace the main drive gear bearing retainer and tighten it to the case securely. (9)—Insert the mainshaft front pilot needle bearings, using grease to hold them in position in the pocket of the main drive gear.

COUNTERSHAFT: (10)—Insert the spacer into the gear. (11)—Place the dummy shaft into the gear and install the needle bearings, using grease to hold them in position. (12)—Install the needle bearing retainer washer at each end of the assembly, then a bronze thrust washer against each retainer and finally, place the steel thrust washer next to the bronze thrust washer at the rear of the assembly. (13)—With the assembly in the bottom of the case and the main drive gear installed as already described, line up the assembly with the holes in the case and drive the dummy shaft out by installing the regular countershaft.

MAINSHAFT: **NOTE**—Be sure that the steel cones are free from score marks or cuts. Scores or cuts on these cones will result in a too severe synchronizing action. The steel cones may be polished with fine emery cloth and finished with a polishing cloth, being careful not to change the angle of the cone. **CAUTION**—The bronze cones should never be polished.

(14)—Place the low gear stop ring on the mainshaft. (15)—Install the second speed gear in position and lock it in place with a new snap ring. (16)—Replace the low speed gear and the synchronizer assembly on the shaft. (17)—Place the assembly into the case and insert the front end of the mainshaft into the main drive gear, being sure that all the pilot bearing rollers are in position. (18)—Install the mainshaft rear bearing and lock it in place with a new snap ring. (19)—Replace the rear bearing retainer and tighten the fastening bolts securely. (20)—Slip the universal joint over the end of the mainshaft and install the locking screw and washer. (21)—Install the speedometer driven gear and complete the assembly by installing the universal ball and its retainers. (22)—If the shift mechanism has been removed, replace in the reverse order of removal, then install the cover and check the operation of the transmission in all gears.

GROUP No. 18

Fig. 71

CADILLAC 1937-42 ALL EXCEPT 37-90
LA SALLE 1937-40 ALL

DISASSEMBLE

NOTE—See the TROUBLE DIAGNOSIS chapter in Group No. 19 as a guide to determine the cause of transmission defects.

(1)—Remove the speedometer driven gear adapter and gear. (2)—Unscrew the bolt which fastens the universal joint to the mainshaft and pull off the flange.

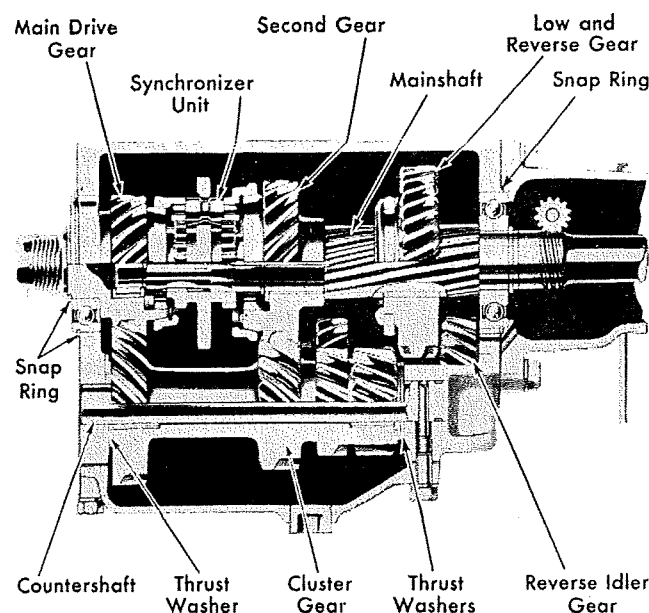


Fig. 71—Group No. 18 Transmission

(3)—Unfasten the mainshaft extension housing from the case and take off the housing. (4)—Remove the transmission top cover. (5)—Unfasten the bottom cover and drive the countershaft out through the rear. **NOTE**—For this operation, use a dummy shaft which is exactly the same length as the cluster gear and thrust washers combined, to hold the needle bearings in place. (6)—Remove the main drive gear lock screws and pry the gear and bearing out of the front of the case. **CAUTION**—After removing the snap ring, be sure to account for 14 needle roller bearings from the pocket of the main drive gear. (7)—Slip the synchronizer assembly from the front of the mainshaft. (8)—Remove the second speed gear snap ring. (9)—Grasp the second and low speed gears and tap the mainshaft and rear bearing out through the rear of the case. (10)—Tap the reverse idler gear shaft out through the rear and lift out the gear and thrust bearings.

NOTE—On 1938-42 cars, remove the shift levers from the shafts and take the shafts out from the inside of the case, being careful not to lose the interlock balls, spring or tubes.

ASSEMBLE

SHIFTER MECHANISM: (1)—On 1938-42 cars, install the second and high shift lever and shaft in the neutral position. (2)—Place the interlock ball, tube and spring assembly in the case. (3)—Compress the interlock spring and install the low and reverse shift shaft, placing the interlock assembly in the neutral position of the sector. (4)—Install new seals at the outer ends of the shift shafts. (5)—Replace the shift levers on their shafts—the shorter one is for second and high and belongs on the front shaft.

TRANSMISSION, OVERHAUL

REVERSE IDLER: (6)—Tap the reverse idler shaft partly into the case. (7)—Install the babbitt thrust washer at the rear of the shaft, placing the clip in the washer in the slot of the case. (8)—Place a new cork seal on the outer end of the shaft. (9)—Slip the reverse idler gear on the shaft, using a suitable pilot which extends through the transmission case boss to hold the front thrust washer in position. (10)—Tap the shaft into position, lining up the locking screw hole in the shaft with the hole in the case.

MAINSHAFT: (11)—Hold the low speed sliding gear in the case and engage the shifter shoe in the channel of the gear. (12)—Insert the mainshaft through the rear of the case and through the low speed sliding gear. (13)—Place the second speed gear on the mainshaft, install the thrust washer and use a new snap ring to lock the gear in position. (14)—Slip the synchronizer assembly on the mainshaft. (15)—Install the mainshaft pilot roller bearings in position in the pocket of the main drive gear and use a new snap ring to lock them in place. (16)—Tap the main drive gear and bearing in position, install the snap ring and retaining screws. (17)—Tap the mainshaft rear bearing into place.

COUNTERSHAFT: (18)—Assemble the dummy shaft into the cluster gear and insert the needle bearings in place at both ends. (19)—Place a bronze thrust washer at each end of the gear and the steel thrust washer next to the bronze thrust washer at the rear end. (20)—Install the assembly in the case and drive out the dummy shaft by installing the regular countershaft. **NOTE**—The end play of the countershaft should not exceed .018"; Oversize washers are available to obtain this clearance. (21)—Install a new cork seal at the outer end of the shaft. **NOTE**—Be sure to line up the lock screw hole in the shaft with the hole in the case. (22)—Replace the bottom cover and install the two long screws that hold the reverse idler and countershafts in their proper positions.

NOTE—Complete the assembly by replacing the extension housing, the extension housing oil seal—if required—the universal joint, speedometer driven gear and adapter housing—being sure that the driven gear is meshed with the drive gear. Then check the operation of the transmission in all gears and install the recommended quantity and type of lubricant.

GROUP No. 19

Figs. 72, 73, 74

BUICK 1939-42 SERIES 40 AND 50
OLDSMOBILE 1939-42 ALL
PONTIAC 1939-42 ALL

TROUBLE DIAGNOSIS

NOTE—The following symptoms may also be used as a guide when servicing transmissions in Groups No. 15, 16, 17, 18, 20 and 22.

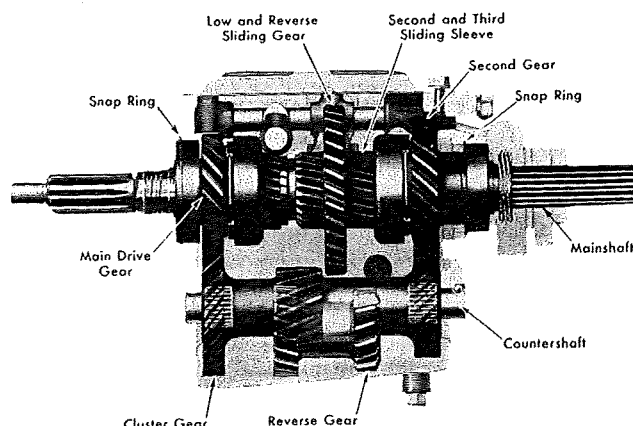


Fig. 72—Group No. 19 Buick Transmission

NOISE IN NEUTRAL: When a constant click is evident when in neutral, it usually indicates a nicked gear or bearing. Check all gears, bearings, and the end-play of all parts which operate in neutral.

GEAR NOISE: If the noise is limited to any one or more transmission speeds, trace the gears under load, and examine for damage.

GEAR CLASH WHEN SHIFTING: If clash occurs when shifting into high or second speed, check for broken detent springs, improper amount of synchronizer end-play, poor synchronizing cone surfaces, or too much mainshaft end-play.

GEAR RATTLE DURING ACCELERATION: If rattle occurs in high gear on wide open throttle, and between 40 and 60 MPH, it is usually caused by improper clutch dampening. A new driven plate should be tried. If the rattle occurs at lower speeds on part throttle, check the vibration damper. Improperly calibrated driven plates or scored axle gears may also be the cause.

NOISE WHEN SHIFTING OUT OF LOW AND REVERSE: If the noise occurs when disengaging the reverse only, the reverse idler gear is probably at fault. If the noise is abnormal when disengaging both low and reverse gears, it indicates that fault is with low speed gear only. Noise when disengaging low speed gear, indicates counter gear is at fault. Tests must be made while car is in motion.

SHIFTER FORK NOISE: Since both shifter forks are being used to position the gears they control, the noise is likely to occur when driving in high gear. If the noise changes as the shift lever is moved slightly, but still retained in the high gear position, it indicates the fault is with the second and high gear fork. This can be remedied by aligning and polishing the contacting surfaces.

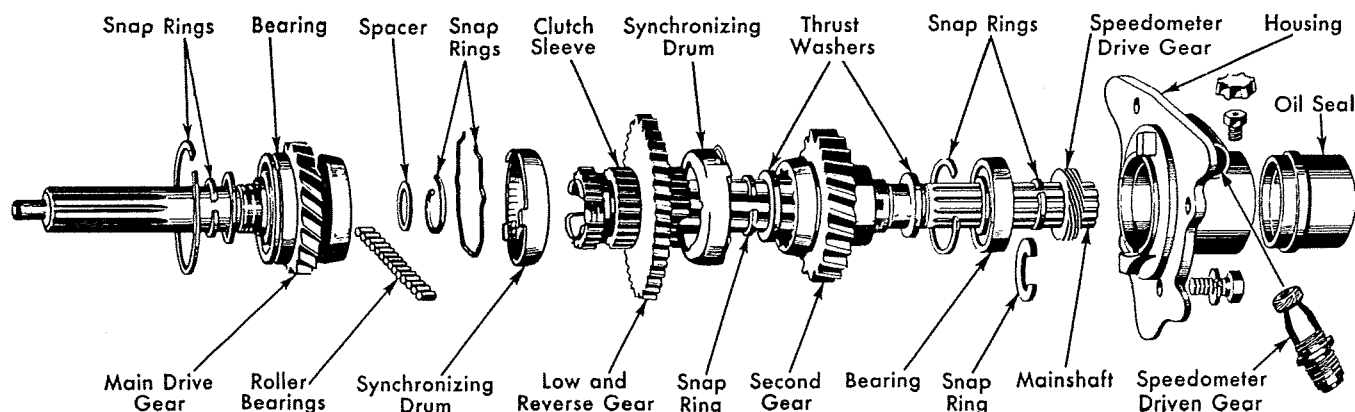


Fig. 73—Group No. 19 Pontiac Main Drive Line

GEAR JUMP-OUT: Jump-out of high gear may be caused by improperly adjusted engine mountings, misalignment of transmission with flywheel, excessive mainshaft end-play, damaged or poor fit of sliding sleeve, or synchronizing unit, in the clutch shaft gear.

Jump-out of second gear may be caused by poor or damaged fit of sliding sleeve, or synchronizing unit, in second speed gear; too loose fit of sliding sleeve or synchronizing unit on the mainshaft, or, excessive mainshaft end-play.

Jump-out of low or reverse may be caused by too loose a fit of the sliding sleeve and low speed gear on the mainshaft.

Loose fit of bearings or bushings may cause jump-out of any gear where they are involved. If the transmission has jumped out of any gear many times while under load, it may be necessary to replace the mating parts affected. This is because the gear teeth of the mating parts have become beveled.

Lack of sufficient tension on the shifter shaft retainer springs may cause jump-out of any gear.

HARD SHIFTING: If this occurs at the start of shift, it may be caused by too much tension on the shifter shaft retaining springs.

Scored synchronizing drums or cones may cause a block-out of high or second gear. Block-out can also be caused by rough cam surfaces on the ends of the sliding sleeve, and on synchronizing drum cams.

TRANSMISSION GREASE PASSING TO REAR AXLE (BUICK): This may be caused by a scored universal joint or bushing; more than .006" clearance between universal joint and bushing; loose adjustment of ball joint, or run-out of front end of propeller shaft.

DISASSEMBLE

(1)—Unfasten the spring and bolt which attaches the shift shaft lever to the selector shaft and remove

the lever. (2)—Remove the transmission cover. (3)—Take out the speedometer driven gear assembly. (4)—Lock the transmission in high gear. NOTE—This will prevent the sliding sleeve and low speed gear from dropping into the case.

NOTE—On Buick cars, if necessary to remove the universal joint, take off the universal ball and retainers. Unscrew the bolt which fastens the universal joint to the end of the mainshaft and use a puller, if necessary, to remove the joint.

(5)—Proceed on all cars by removing the bolts which fasten the rear bearing retainer to the case and slide the retainer, together with the second speed gear and mainshaft out through the rear of the case. (6)—Remove the set screws from the shift forks and selector shaft cams. NOTE—If the sliding sleeve and low speed gear are not to be removed, the selector shaft and shift rails need not be taken out. When removing the set screws, do not use a screw driver with a tapered bit to avoid the possibility of spreading the screw slots. A special tool is available which completely fills the screw slots, thereby greatly facilitating the removal of these screws. (7)—Use a soft hammer and drive the selector shaft through the right side of the case, being careful not to allow the shifting cams to drop into the case. (8)—Remove the shift rails by sliding them through the forks and out through the rear of the case, being sure to collect the balls and springs which are under the rails. (9)—Slip the sliding sleeve out of the main drive gear and lift out the sleeve and low speed gear. (10)—Drive the countershaft out through the rear of the case, allowing the cluster gear to lie in the bottom of the case. NOTE—For this operation, use a dummy shaft which is exactly the same length as the cluster gear and thrust washers combined, to avoid losing the needle bearings. (11)—Remove the main drive gear bearing snap ring and tap the gear into the case and lift it out. (12)—Lift out the cluster gear assembly. (13)—Drive the reverse idler shaft lock pin into the shaft, tap out the shaft and lift out the gear.

TRANSMISSION, OVERHAUL

MAINSHAFT: (14)—Pry the synchronizing drum retainer over the shoulder on the second speed gear and remove the synchronizing drum. (15)—Take off the second speed gear snap ring and remove the gear and front thrust washer. (16)—Expand the mainshaft rear bearing snap ring and slide it off the shaft. (17)—Hold the rear bearing housing and bump the end of the mainshaft on a block of wood to release it from the housing. (18)—Remove the snap ring from the rear of the bearing and take off the bearing, thrust washer, speedometer drive gear and spacer. **NOTE**—Do not remove the oil seal from the housing unless it is to be replaced.

MAIN DRIVE GEAR: (19)—Pry the synchronizing drum retainer over the shoulder of the gear and remove the drum. (20)—Remove the small snap ring and washer which retains the bearing on the shaft. (21)—Bump the shaft on a block of wood to remove the bearing. (22)—If the mainshaft pilot needle bearings are to be removed, take out the snap ring and remove the retainer and bearings.

EXTENSION HOUSING: On Oldsmobile 125" wheelbase cars, a steel-backed bronze bushing is used at the rear of the housing to support the mainshaft. If necessary to replace this bushing, the new bushing should be reamed to obtain a running clearance between its inside diameter and the mainshaft of from .0025" to .004".

NOTE—In addition to the regular amount of transmission lubricant, this housing should be supplied with $\frac{1}{2}$ pint of lubricant after the transmission is installed in the chassis and the propeller shaft in place.

INSPECTION

(a)—Examine the teeth of all gears for evidence of pitting. (b)—Bearings should show no score marks on either the rollers or races; make sure they turn freely. (c)—The sliding sleeve must slide freely on the mainshaft. (d)—Synchronizing drums must be smooth and free from scores and should show the heaviest contact on their large diameters. (e)—Be sure to clean all oil grooves.

ASSEMBLE

REVERSE IDLER: Be sure to install a thrust washer at each end of the gear. When installed, the outer end of the locking pin should be $\frac{3}{4}$ " inside the case.

COUNTERSHAFT: To assemble, install the bearing spacer and insert the dummy shaft into the gear. Assemble the needle bearings in place, install the bearing retainers and thrust washers, then place the entire assembly into the bottom of the case. **NOTE**—Allow the assembly to lie in the bottom of the case until after the main drive gear is installed.

MAIN DRIVE GEAR: Assemble the parts in the reverse order of their removal, being sure the shielded side of the bearing is placed toward the rear. Press the bearing on the shaft, using a tube or pipe against

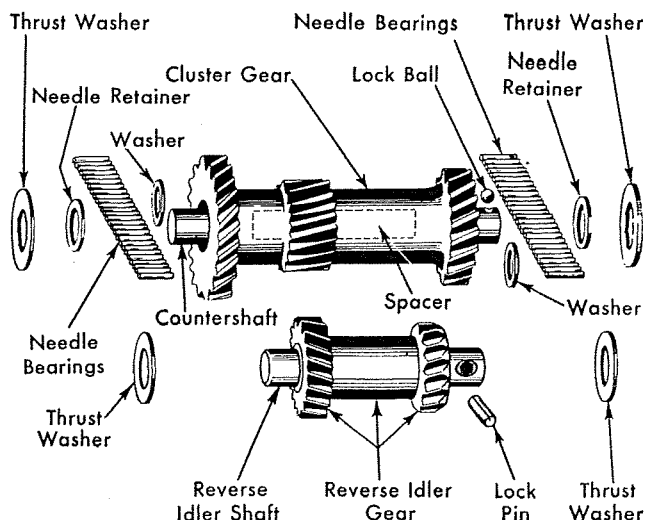


Fig. 74—Group No. 19 Pontiac-Buick-Olds Countershaft and Reverse Gears

the inner race of the bearing. Replace the assembly through the inside of the case. **NOTE**—After the main drive gear is installed, align the countergear assembly with the holes in the case and drive the dummy shaft out by installing the regular countershaft through the rear of the case. Before driving the shaft all the way into position, be sure to align the slots in the shaft and case and insert the locking ball.

MAINSHAFT: Assemble the parts on the mainshaft in the reverse order of their removal. Install the low speed gear on the sliding sleeve and mesh the sleeve into the high speed cone. Insert the mainshaft through the rear of the case, sliding it through the sleeve and into the pilot bearings in the pocket of the main drive gear. Bolt the rear bearing retainer securely and replace the speedometer driven gear. **NOTE**—On Buick cars, replace the universal joint, the ball and its retainers.

SHIFTER MECHANISM: Assemble these parts in the reverse order of their removal, being sure to install a new welch plug after replacing the selector shaft. **NOTE**—If the inner selector lever and shaft has been removed, be sure to install the spring washer, the plain washer and the oil seal on the shaft in that order.

GROUP No. 20

Figs. 75, 76

BUICK 1935-38 SERIES 40 AND 50
OLDSMOBILE 1935-38 ALL
PONTIAC LATE 1935 AND ALL 1936-38

DISASSEMBLE

NOTE—See the TROUBLE DIAGNOSIS chapter in Group No. 19 as a guide to determine the cause of transmission defects.

(1)—Take off the transmission cover, interlock plate and shift bar. (2)—Remove the shift rails and forks, noting that the second and high shift rail is the shorter of the two. (3)—Take out the speedometer driven gear assembly.

NOTE—On Oldsmobile cars, lock the transmission in two gears to prevent the mainshaft from turning and loosen the nut from the companion flange.

(4)—Unbolt the rear bearing retainer from the case and turn the retainer clockwise to release it from the slot in the end of the countershaft. **NOTE**—This is not necessary on 1938 Buick and Pontiac cars as these countershafts are retained by a locking ball.

(5)—Drive the countershaft out through the rear, allowing the cluster gear and thrust washers to lie in the bottom of the case. (6)—Hold the low speed sliding gear and pull the rear bearing retainer and mainshaft assembly out through the rear of the case. (7)—Remove the main drive gear bearing retainer, release the snap ring from its outer race and tap the assembly into the case and lift it out. (8)—Lift the cluster gear and thrust washers from the transmission. (9)—Remove the reverse idler shaft lock screw, tap out the shaft and lift out the gear and thrust washers, noting that the large thrust washer is at the front.

MAINSHAFT: Slip the sliding sleeve and flat detent springs from the mainshaft. Remove the snap ring or wire retainer and slide the second speed synchronizing drum from the shaft.

On Buick 1936-38 and Pontiac 1935-36 cars, remove the universal ball and its retainers, pull the universal joint from the shaft and press the mainshaft out of the universal front yoke and bearing. The second speed gear may now be removed from the mainshaft.

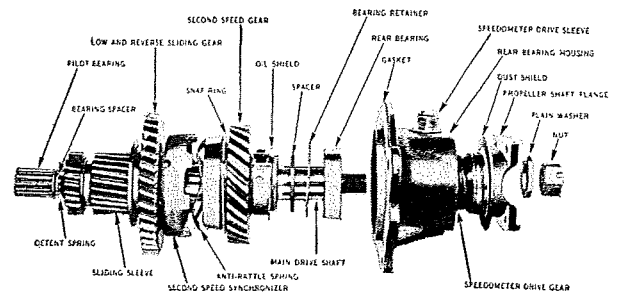


Fig. 75—Group No. 20 Oldsmobile Main Drive Shaft Parts

On 1937-38 Pontiac cars, press the mainshaft out of the propeller shaft coupling and speedometer drive gear assembly. Remove the mainshaft rear bearing and second speed gear from the shaft.

On Oldsmobile cars, take off the flange nut, washer and companion flange. Bump the end of the mainshaft on a block of wood to release it from the rear bearing retainer. To remove the bearing, take out the second speed oil sleeve, release the snap ring and press off the bearing. The second speed gear may now be removed from the shaft.

MAIN DRIVE GEAR: Release the snap ring or wire retainer and slide the high speed synchronizing drum from the shaft. On 1935-36 cars, unscrew the main drive gear thrust nut (left hand thread). The bearing may now be removed by bumping the shaft on a block of wood. On 1937-38 cars, remove the snap ring and spring washer and bump the shaft on a block of wood to remove the bearing.

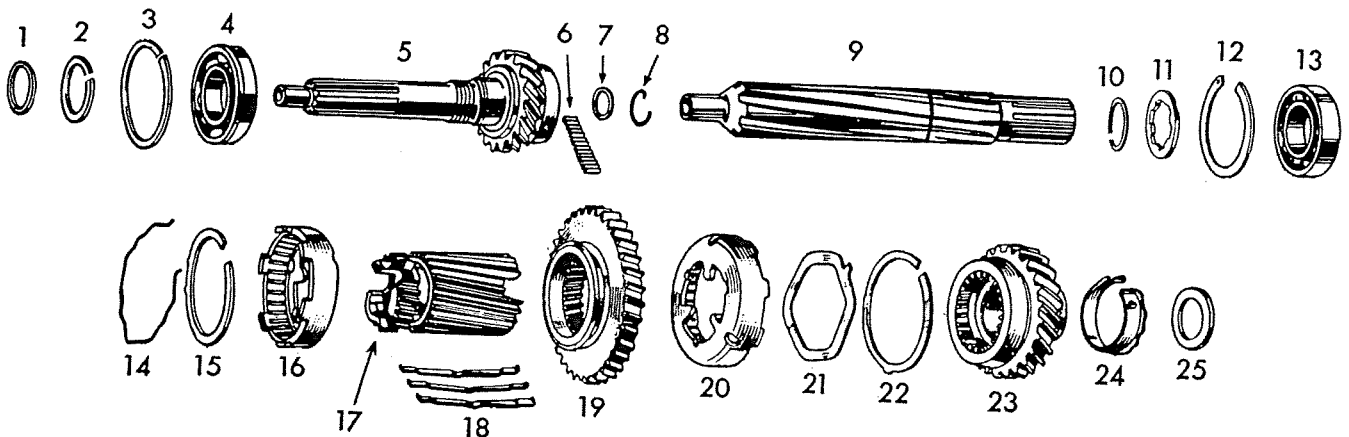


Fig. 76—Group No. 20 Transmission

- 1—M.D. gear spring washer
- 2—M.D. gear snap ring
- 3—M.D. gear bearing snap ring
- 4—M.D. gear bearing
- 5—M.D. gear
- 6—M.S. pilot bearing roller
- 7—M.S. pilot bearing washer

- 8—M.S. pilot bearing roller snap ring
- 9—Main shaft
- 10—M.S. snap ring
- 11—Second speed gear thrust washer
- 12—M.S. rear bearing retaining ring
- 13—M.S. rear bearing

- 14—Synchronizing drum retainer spring
- 15—Synchronizing drum retainer stamping
- 16—Front synchronizing drum
- 17—M.S. sleeve
- 18—Synchronizer detention springs

- 19—Low and reverse sliding gear
- 20—Rear synchronizing drum
- 21—Synchronizing drum cushion ring
- 22—Rear synchronizing drum retainer stamping
- 23—Second speed gear
- 24—Second speed gear oil sleeve
- 25—Second speed gear thrust washer

TRANSMISSION, OVERHAUL

INSPECTION

(a)—Examine the teeth of all gears for evidence of pitting. (b)—Bearings should show no score marks on either the races or rollers; make sure they turn freely. (c)—Synchronizing drums must be smooth and free from scores and should show their heaviest contact on their large diameters. (d)—Be sure to clean all oil grooves.

ASSEMBLE

REVERSE IDLER: Be sure to install a thrust washer at each end of the gear, placing the larger washer at the front.

COUNTERSHAFT: Assemble the cluster gear and thrust washers in the bottom of the case. **NOTE**—Do not install the countershaft until after the main drive gear is replaced. When the shaft is in place, be sure that the slot (except Buick and Pontiac 1938) in the end of the shaft is positioned correctly to permit the mainshaft rear bearing retainer to engage and lock it in position. On 1938 Buick and Pontiac cars, be sure to align the slots in the shaft and case and insert the lock ball.

MAIN DRIVE GEAR: Assemble the parts in the reverse order of their removal, being sure that the shielded side of the bearing is placed toward the rear. Press the bearing on the shaft, using a tube or pipe against the inner race of the bearing. Replace the assembly through the inside of the case. The countershaft may now be installed.

MAINSHAFT: Assemble the parts on the mainshaft in the reverse order of their removal. Hold the low speed sliding gear in the case and insert the mainshaft assembly through the rear of the case and through the low speed gear. Bolt the rear bearing retainer securely and replace the speedometer driven gear. **NOTE**—On Pontiac 1935-36 and Buick cars, replace the universal joint, the ball and its retainers.

SHIFTER MECHANISM: Assemble shift rails and forks—the second and high shift rail being the shorter of the two. Replace the transmission cover assembly.

GROUP No. 21

Fig. 77

WILLYS 1933-36 ALL

DISASSEMBLE

(1)—Disconnect the transmission cover from the case and lift it off. (2)—Remove the shift fork lock screws and drive the shift rails through the forks and out of the case. (3)—Lock the transmission in two gears to prevent the mainshaft from turning and remove the nut and washer from the end of the mainshaft. (4)—Use a puller, if necessary, to take off the companion

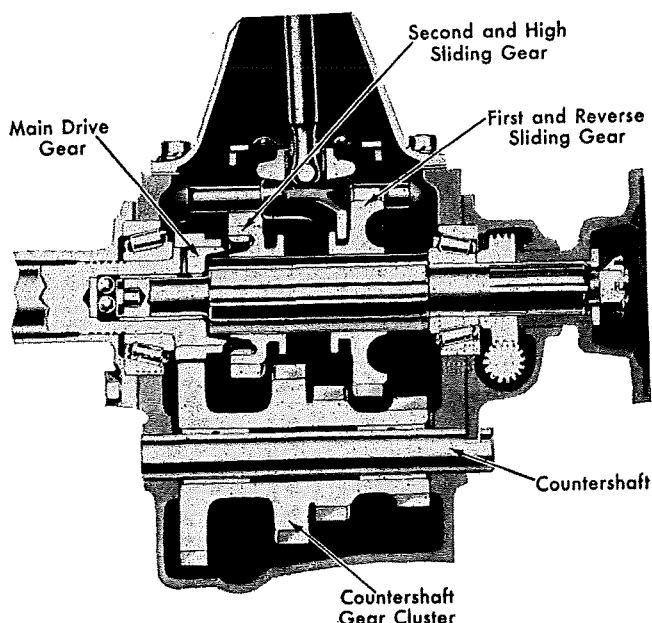


Fig. 77—Group No. 21 Transmission

flange. (5)—Remove the speedometer driven gear. (6)—Unscrew the mainshaft rear bearing retainer and turn it clockwise to release it from the slot in the countershaft, then remove the retainer. (7)—Remove the main drive gear bearing retainer and tap the gear and bearing out through the front. (8)—Hold the mainshaft sliding gears and pull the mainshaft and rear bearing out through the rear. (9)—Drive the countershaft out rearward and lift out the cluster. (10)—Tap the reverse idler shaft out through the rear and lift out the gear.

ASSEMBLE

The procedure for assembly is exactly the reverse of disassembly.

GROUP No. 22

Fig. 78

CADILLAC 1936, 36-60
LA SALLE 1935-36 ALL

DISASSEMBLE

NOTE—See the TROUBLE DIAGNOSIS chapter in Group No. 19 as a guide to determine transmission defects.

(1)—Take off the transmission cover and disassemble, being careful not to lose the lock balls and springs. (2)—Remove the speedometer driven gear. (3)—Pull off the transmission companion flange and remove the rear bearing retainer. (4)—Drive the countershaft out rearward, allowing the cluster gear

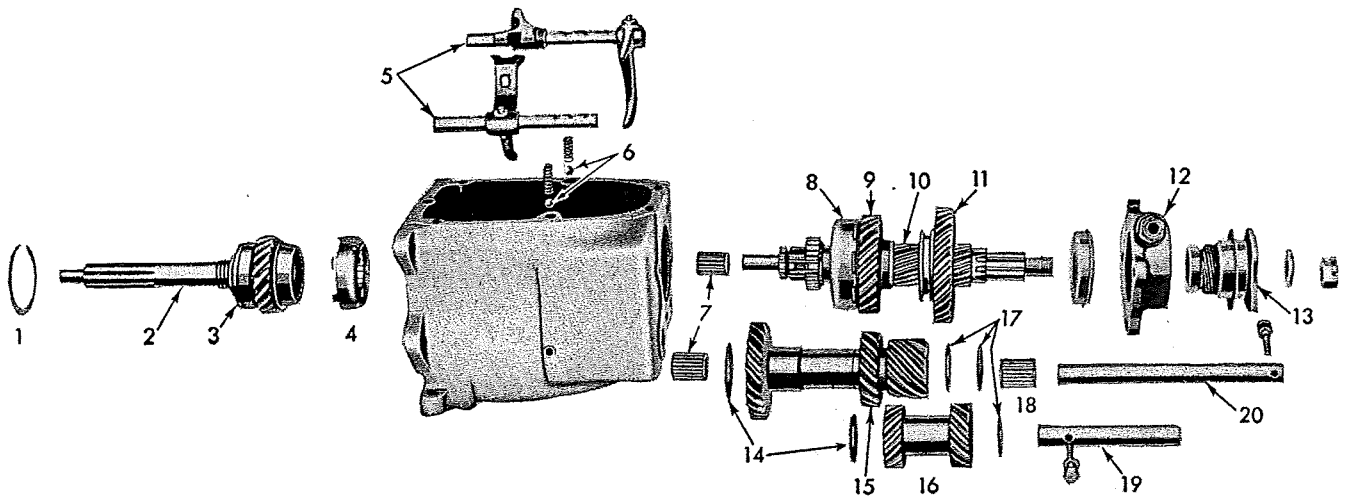


Fig. 78—Group No. 22 Transmission

1—Snap ring
2—Main drive gear
3—Bearing
4—Synchronizing drum
5—Shift shafts and forks

6—Poppet balls and springs
7—Bearings
8—Synchronizing drum
9—Second gear
10—Mainshaft

11—Low and reverse gear
12—Rear bearing retainer
13—Universal joint flange
14—Thrust washers
15—Cluster gear

16—Reverse idler gear
17—Thrust washers
18—Bearing
19—Reverse idler shaft
20—Countershaft

to lie in the bottom of the case. (5)—Remove the main drive gear bearing snap ring and the snap ring from the inner circumference of the high speed drum. (6)—Pull the main drive gear forward as far as possible. NOTE—Do not attempt to remove it until the mainshaft assembly is removed. (7)—Tap the mainshaft rear bearing out through the rear. (8)—Shift the mainshaft assembly back far enough to disengage it from the main drive gear, then lift it out through the top. (9)—Push the main drive gear back into the case and lift it out through the top. (10)—Remove the cluster gear assembly from the case. (11)—Unscrew the idler shaft lock bolt, tap the shaft out through the rear and lift the gear and thrust washers out of the case.

MAINSHAFT: (a)—To disassemble, remove the low speed gear, mainshaft pilot bearing, high speed synchronizing drum and sliding coupling, being careful not to lose the three long and three short detent springs. (b)—Remove the second speed synchronizing drum by releasing its snap ring, being careful not to damage the release spring inside the drum. (c)—Slide the second speed gear from the shaft after removing its snap ring.

ASSEMBLE

REVERSE IDLER: Assemble the gear in the case with the small thrust washer at the rear. Tap in the shaft and line up the lock screw hole with the hole in the case, then install the lock screw securely.

COUNTERSHAFT: Use a tapered dummy shaft to position the cluster gear, thrust washers and roller bearings into the case. NOTE—Be sure to install the pronged thrust washer at the rear. Allow the assembly to lie in the bottom of the case until after the main drive gear and mainshaft assembly are installed.

MAIN DRIVE GEAR: Replace this assembly into the case and pull it forward as far as possible, leaving it in this position until the mainshaft assembly is installed.

MAINSHAFT: Assemble the parts in the reverse order of their removal, being sure to insert the long detent springs so they engage the high speed drum and the short detent springs so they engage the second speed drum. NOTE—These springs must be installed alternately around the mainshaft. Replace the mainshaft pilot bearing. Install the mainshaft rear bearing, bearing retainer and companion flange. Push the main drive gear back into its proper position and install its snap ring. CAUTION—Be sure to replace the snap ring into the inner circumference of the high speed drum.

NOTE—Complete the assembly by installing the countershaft. To insure proper synchronization, use the specified type and quantity of lubricant. Too much lubricant will most likely cause a pressure to be built up in the transmission which will force the lubricant into the clutch housing where it may reach the clutch facings.

GROUP No. 23

Fig. 79

CADILLAC 1935 ALL, 1936 EXCEPT 36-60, 1937, 37-90

DISASSEMBLE

(1)—Take off the cover and disassemble by removing the spring attached to the second and high speed yokes. (2)—Remove the yoke stop and oil trough which lubricates the universal joint. (3)—Take off the yoke adjusting quadrants and eccentrics, then remove the yokes. (4)—Remove the plunger assemblies from

TRANSMISSION, OVERHAUL

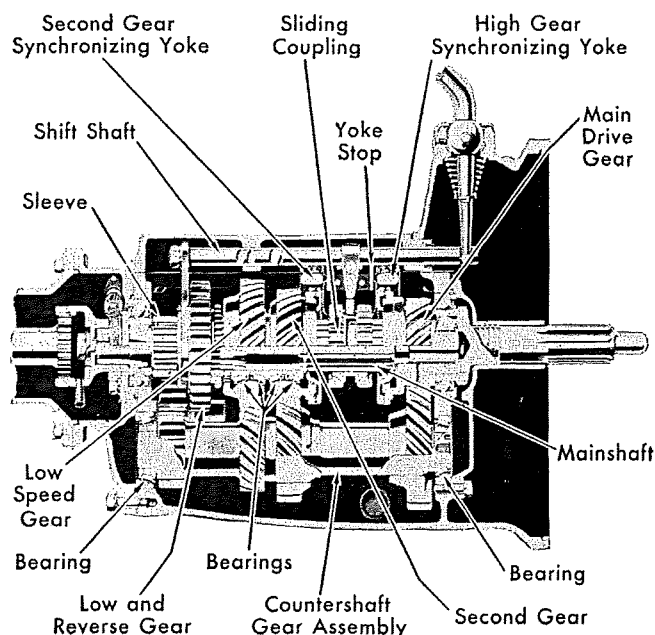


Fig. 79—Group No. 23 Transmission

the yokes and disassemble them by removing the valve spring retainer which is attached to the bottom of the valve. (5)—Pull off the universal flange and remove the rear bearing retainer. (6)—Withdraw the front propeller shaft and bearing, then remove the housing. (7)—Remove the speedometer driven gear and front propeller shaft housing. (8)—Unscrew the bolt from the end of the mainshaft and take off the front propeller shaft coupling. (9)—Remove the reverse idler gear cover, unscrew the lock bolt and remove the gear and shaft. (10)—Unscrew the bolt at each end of the countershaft cluster and remove the bearings, which will allow the cluster gear to drop out of mesh with the mainshaft gears. (11)—Slide the clutch throwout bearing off the main drive gear bearing retainer and detach the retainer. (12)—Release the snap ring and remove the main drive gear bearing, after which, the gear may be pulled out through the front. (13)—Remove the mainshaft rear bearing and lift the mainshaft assembly out through the top. (14)—Lift out the cluster gear assembly.

MAINSHAFT: To disassemble, pull the splined sleeve, together with the sliding gears and bearings off the rear of the shaft. Remove the synchronizer mechanism from the front of the shaft.

ASSEMBLE

Reverse the order of procedure to assemble, paying particular attention to the following:

MAINSHAFT: To maintain proper adjustment of the tapered roller bearings for the low and second speed gears on the mainshaft, make sure that mainshaft retaining screw is securely tightened. The low

and second speed gears should have a slight drag when the bearings are properly adjusted. If the bearings are loose, dress down both spacers between the bearings until a slight drag is felt on the gears. Measure the thickness of the spacers after dressing, with a micrometer, to make sure they are the same thickness all around the surface. This precaution is for the purpose of avoiding the possibility of slipping out of low and intermediate gears.

SHIFTER MECHANISM: When installing the shifter mechanism, install the plunger assemblies into the second and high speed yokes. Set the yokes in place and install the four quadrants with the eccentric shafts, and set the screws in loosely. Install the oil trough, and the two bolts which hold the second and high yoke and the yoke stop. Fasten the pull back spring to the top of the two yokes, using a small pry bar to shift the yokes. Measure the distance between the top of the rear yoke when it is in the neutral position, and also, when in the rear position, to determine the clearance between the rear drum and the cone, which should be from $\frac{3}{32}$ " to $\frac{5}{32}$ ". Repeat this procedure with the front yoke. To increase the travel of the high gear yoke, turn the high speed adjusting quadrant clockwise. To decrease the travel, adjust the quadrant anti-clockwise. To increase the travel of the second gear yoke, turn the second gear adjusting quadrant anti-clockwise. Turn the quadrant clockwise to decrease the yoke travel. Make sure that the quadrants are adjusted an equal amount to avoid unequal and rapid wear.

TRANSMISSION ALIGNMENT: Be sure that the dowel pins, which are fitted to the flywheel housing so as to align the transmission, are not bent or cocked. If either pin is cocked, the transmission may jump out of high gear. If this condition arises, the dowel hole in the transmission case should be relieved so that the pin does not contact the housing when in position, which will eliminate the effect of the pin on the alignment of the transmission.

LUBRICANT: Make sure that the specified lubricant is used, to eliminate the possibility of gear clash. If the lubricant becomes too thin, the proper operation of the synchronizing mechanism will be affected.

GROUP No. 24

Fig. 80

BUICK 1933 ALL. 1934-35 SERIES 60 AND 90

DISASSEMBLE

(1)—Take off the shift lever housing. (2)—Place the gears in neutral and remove the cover. (3)—Remove the oil seal at the front end of the countershaft and the cotter pin at its rear end. (4)—Drive the countershaft out rearward, allowing the cluster gear to lie in the bottom of the case. (5)—Take out the main drive gear, its bearing and retainer through the front. (6)—Disconnect the mainshaft rear bearing

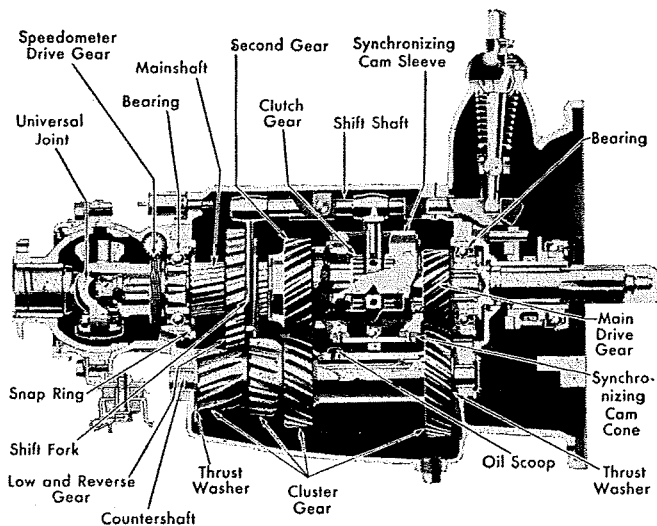


Fig. 80—Group No. 24 Transmission

retainer and rotate 90 degrees. (7)—Raise the front end of the mainshaft assembly and take off the synchronizer assembly. **NOTE**—This unit is serviced as an assembly only. (8)—Replace the rear bearing retainer and secure it to the case by one nut. (9)—Release the second speed gear snap ring from the groove in the mainshaft. (10)—Strip the mainshaft by removing the second speed front thrust washer, second speed gear, the rear thrust washer and the low speed gear. (11)—Remove the mainshaft and rear bearing retainer through the rear of the case. (12)—Lift out the countershaft cluster gear assembly. (13)—Remove the reverse idler shaft lock pin, drive the shaft out rearward and lift out the gear.

ASSEMBLE

REVERSE IDLER: Line up the thrust washers and idler gear and insert the shaft through the rear of the case, then install the lock pin.

COUNTERSHAFT: Assemble the cluster gear with the steel washer at the rear and the bronze washer at the front, then place the assembly into the bottom of the case. **NOTE**—Do not install the countershaft until after the mainshaft and main drive gear is replaced.

MAINSHAFT: (a)—Install the mainshaft and rear bearing retainer through the rear of the case and hold in position by replacing one nut. (b)—Then slide the low speed gear on the shaft, install the second speed gear rear thrust washer, the second speed gear and finally, the front thrust washer, being sure it seats properly in its groove in the mainshaft. (c)—Remove the nut which is used to hold the rear bearing retainer temporarily to the case, tilt the front end of the mainshaft upward and slide the synchronizer assembly into

position on the mainshaft. (d)—Bolt the rear bearing retainer securely to the case.

MAIN DRIVE GEAR: Insert the mainshaft front pilot bearing in the pocket of the main drive gear, slip the assembly through the front of the case and tighten the retainer securely. **NOTE**—The countershaft cluster may now be installed by tapping the countershaft in from the rear. Replace the oil seal at the front and the cotter pin at the rear.

NOTE—Complete the assembly by placing the gears in neutral, install the shifter cover and lever housing. Check the transmission in all gears for freedom of operation.

GROUP No. 25

Figs. 81, 82

CHRYSLER 6, 1941-42. DE SOTO 1941-42

UNDERDRIVE—SEMI-AUTOMATIC TRANSMISSION DISASSEMBLE

(1)—Take out the governor and the speedometer driven pinion. (2)—Lock the transmission in reverse and shift the synchronizer clutch sleeve into its forward position—which will prevent the mainshaft from turning. (3)—Take off the hand brake drum. (4)—Use a suitable puller (or tool No. C-497) to remove the oil seal. (5)—Remove the detent ball retaining screws and springs from the gearshift housing. (6)—Place the gearshift levers in neutral and lift off the gearshift housing. (7)—After loosening the brake support, turn it counter-clockwise to expose the gearshift rail holes, after which, the shifting fork and the reverse idler shaft retainer screws may be removed. (8)—Slide the shifting rails out through the back of the case—top rail first. **NOTE**—When removing the lower rail, be careful not to lose the detent balls and spacer. (9)—Remove the reverse shift fork. (10)—Detach the main drive gear bearing retainer, and then, remove the main shift fork guide pin by unscrewing and pulling it out of the front of the case; the manual shift fork may now be removed.

(11)—Using a suitable puller, remove the reverse idler shaft by pulling it out through the rear and lift out the reverse idler gear. (12)—Use an arbor to drive the countershaft out through the rear, allowing the countershaft gearset to drop to the bottom of the case, after which, the mainshaft and gear assembly may be taken out through the rear of the case. (13)—Remove the main drive gear and synchro-clutch sleeve, and then, lift out the countershaft gear assembly.

NOTE—A shifter rail selector plug is located in the vertical drilled hole on top of the transmission case. The hole is sealed by a cupped plug. Drive the cupped plug down into the selector plug hole, then remove the selector plug.

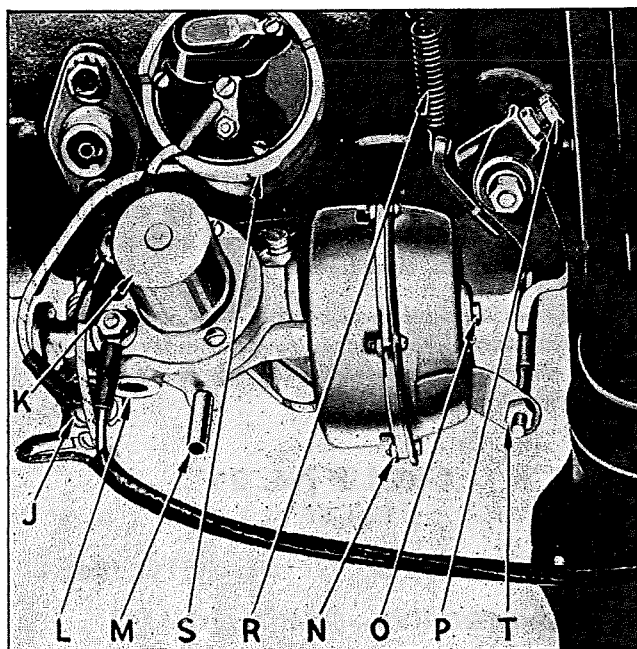


Fig. 81—Group No. 25 Transmission Controls

K—Solenoid	N—Vacuum diaphragm
J—Ignition interrupter switch	R—Shift spring
L—Atmospheric connection	T—Lockout control
M—Vacuum connection	O—Vacuum diaphragm shaft
S—Governor switch	P—Stop adjustment

COUNTERSHAFT: (a)—To disassemble, remove the snap ring which retains the free-wheeling gear in the end of the cluster gear. (b)—Lift off the free-wheeling gear and remove the thrust washer. (c)—Remove the roller bearings and the free-wheeling rollers, being careful not to lose the two springs under the roller cage when removing the cage.

MAINSHAFT: (a)—To disassemble, remove the blocker ring and the synchro-clutch spreader spring. (b)—Clamp the mainshaft upright in a vise, holding it by its rear end. (c)—Remove the third speed gear snap ring and gear, being careful not to lose either the bronze thrust washer or the roller bearings and bearing thrust washer. (d)—Release the manual shift third speed gear stop ring, thrust washer, clutch sleeve and shifting plates. (e)—Strike the rear end of the shaft with a soft hammer and remove the brake support. NOTE—Since the reverse gear is splined onto the mainshaft, it will be necessary to remove it by using an arbor press or a suitable puller.

SHIFT LEVER HOUSING: (a)—To disassemble, remove the nuts which hold the cross-over shaft and lift off the lever, after which, the cross-over shaft and lever assembly may be removed. (b)—Pry the shift lever pin retaining spring out of the pin holes and remove the pin. (c)—Remove the set screw from the housing. (d)—Compress the tension coil spring and slide out the shaft.

ASSEMBLE

Before assembling, be sure that all parts are washed thoroughly in kerosene and wiped dry. Clean the case inside and out. Be sure to oil all bearings and other moving parts as they are assembled.

If the synchro-clutch shaft and fork have been removed from the case, install the fork with its stop block on the right hand side of the case; then install the lower shaft, oil seal, set screw, lever, lockwasher and nut.

COUNTERSHAFT: (1)—To assemble, place the two roller cage springs in position and install the cage, prying the springs under the cage. (2)—Using cup grease, place the free-wheeling rollers in position and install the roller thrust washer with its beveled side toward the rollers. (3)—Turn the roller cage clockwise, holding the rollers in place and install the countershaft free-wheeling gear.

(4)—With aid of cup grease to hold them in place, install the rollers in the forward end of the cluster gear for the free-wheeling gear, then, install the roller bearing retainer washer and a new snap ring. NOTE—The end play between the free-wheeling gear and the cluster gear should be from .003" to .009". Snap rings of various thicknesses are available to obtain this clearance.

(5)—To install the countershaft rollers, install the arbor—which was used to drive out the countershaft—through the gearset, and stand the assembly on its end with the free-wheeling gear up. (6)—Install one of the large steel bearing spacers and using cup grease, insert 25 rollers in the end of the countershaft. (7)—Then install the small steel spacer and the large bronze thrust washer.

(8)—Turn the assembly over and stand it on its forward end. (9)—Install the large steel spacer and the 25 rollers in the same manner. (10)—Then place the large steel thrust washer next to the cluster gear and the large bronze thrust washer on top of the steel thrust washer. NOTE—Be sure that the bronze washer is placed next to the transmission case.

(11)—Install the assembly into the bottom of the case, but do not install the regular countershaft until after the mainshaft has been assembled in the case.

NOTE—The end play of the cluster gear should be from .005" to .011" as measured with a feeler between the bronze thrust washer and the rear of the case. Thrust washers of several thicknesses are available to obtain this clearance.

MAINSHAFT: (1)—To assemble, install a new snap ring in the forward end of the mainshaft spline. (2)—Place the synchronizer hub on the shaft with its large portion toward the rear. (3)—Spring the synchronizer shifting plate springs on the hub. (4)—Insert one of the hooks of the spring in a groove of the shifting plate, then, install the rear spring with its hook in the same groove.

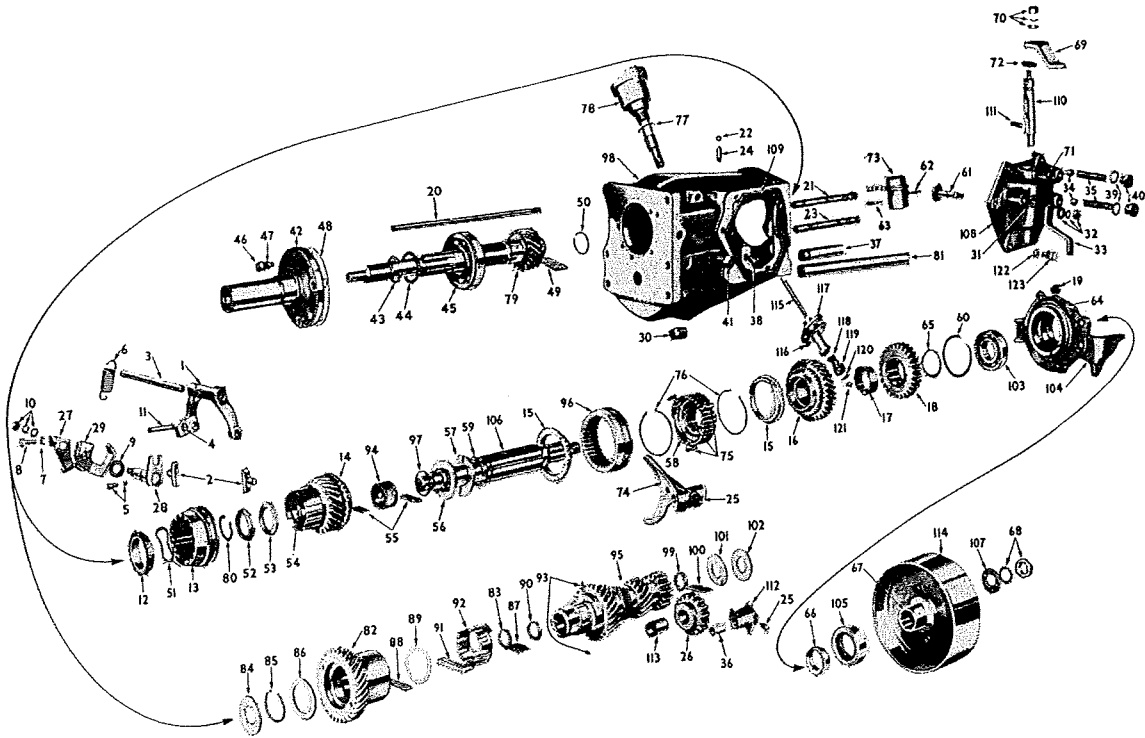


Fig. 82—Group No. 25 Underdrive—Semi-Automatic Transmission

- | | | | |
|------------------------------------|---|-------------------------------------|--------------------------------------|
| 1—Kickdown shift fork and pin | 32—Gearshift operating lever nut, lockwasher and washer | 62—Gearshift lever pin | 93—Cam roller retainer spring |
| 2—Kickdown shift fork shoes | 33—Gearshift selector lever | 63—Lever pin lock spring | 94—Third gear bearing spacer |
| 3—Kickdown shift fork shaft | 34—Gearshift selector ball | 64—Brake support gasket | 95—Countershaft gear |
| 4—Kickdown shift fork pin | 35—Selector ball spring | 65—Reverse gear washer | 96—Clutch gear sleeve |
| 5—Operating shaft lock screw | 36—Reverse idler stop | 66—Mainshaft flange spacer | 97—Third gear bearing washer |
| 6—Operating lever spring | 37—Reverse idler shaft | 67—Mainshaft flange | 98—Transmission case |
| 7—Operating lever stop screw nut | 38—Reverse shaft lock screw | 68—Mainshaft flange nut | 99—Center bearing thrust washer |
| 8—Operating lever stop screw | 39—Selector ball spring washer | 69—Gearshift operating lever | 100—Countershaft bearing rollers |
| 9—Operating lever shaft seal | 40—Selector ball spring screw | 70—Operating lever nut and washers | 101—Thrust washer plate |
| 10—Operating lever nut and washers | 41—Filler plug | 71—Shift lever shaft | 102—Thrust washer |
| 11—Kickdown shift fork stop pin | 42—Drive gear bearing retainer | 72—Gearshift housing seal | 103—Mainshaft rear bearing |
| 12—Direct speed blocker ring | 43—Drive gear bearing snap ring | 73—Gearshift lever | 104—Brake support |
| 13—Direct speed clutch sleeve | 44—Drive gear bearing washer | 74—Low speed shift fork | 105—Rear bearing oil seal |
| 14—Direct and third gear | 45—Drive gear bearing | 75—Synchronizer shifting plates | 106—Mainshaft |
| 15—Synchronizer stop rings | 46—Bearing retainer screw | 76—Synchronizer spring | 107—Flange washer |
| 16—First speed gear | 47—Retainer screw grommet | 77—Kickdown governor gasket | 108—Gearshift housing |
| 17—Speedometer drive gear | 48—Bearing retainer gasket | 78—Kickdown governor | 109—Gearshift housing gasket |
| 18—Reverse gear | 49—Mainshaft pilot bearing rollers | 79—Main drive gear | 110—Gearshift lever shaft |
| 19—Brake support screw | 50—Pilot bearing snap ring | 80—Third gear snap ring | 111—Shift lever return spring |
| 20—Shift fork guide rail | 51—Synchronizer blocker spring | 81—Countershaft | 112—Reverse shift fork |
| 21—Low speed shift rail | 52—Third gear thrust plate, front | 82—Countershaft free wheel gear | 113—Reverse idler gear bushing |
| 22—Shift rail interlock plug | 53—Third gear thrust washer, front | 83—Front bearing thrust washer | 114—Brake drum |
| 23—Reverse shift rail | 54—Third gear thrust bushing, front | 84—Countergear thrust washer | 115—Speedometer pinion shaft |
| 24—Shift rail interlock | 55—Third gear bearing rollers | 85—Countergear snap ring | 116—Speedometer pinion sleeve gasket |
| 25—Shift fork lock screws | 56—Direct and third thrust washer | 86—Free wheel gear thrust washer | 117—Speedometer pinion sleeve |
| 26—Reverse idler gear | 57—Third gear thrust plate, rear | 87—Countershaft bearing rollers | 118—Speedometer pinion oil seal |
| 27—Kickdown operating lever | 58—Synchronizer clutch gear | 88—Free wheel gear roller bearings | 119—Speedometer pinion |
| 28—Inner lever and shaft | 59—Clutch gear snap ring | 89—Free wheel bearing thrust washer | 120—Speedometer pinion washer |
| 29—Kickdown adjusting lever | 60—Mainshaft rear bearing snap ring | 90—Center bearing thrust washer | 121—Speedometer pinion lock |
| 30—Drain plug | 61—Shift selector cam and shaft | 91—Free wheel cam roller | 122—Shift housing screw grommet |
| 31—Shift selector shaft seal | | 92—Cam roller retainer | 123—Gearshift housing screw |

(5)—Install the rear stop ring, low speed gear, speedometer drive gear and the reverse gear on the shaft. NOTE—Be sure that the long end of the hubs of the low and reverse gears are toward the rear of the transmission. (6)—Install the washer on the rear end of the mainshaft.

(7)—Press the reverse gear on the mainshaft. NOTE—If this operation is performed in an arbor press, install the brake support and drum temporarily so that the reverse gear can be pressed back against the bearing in the brake support. Check the end play between the speedometer drive gear and the low speed

gear, which should be from .003" to .009" as measured between the shoulders of both gears. Spacers of various thicknesses are available to obtain this clearance. Now remove the brake drum.

(8)—Install the synchronizer shifting plates and the sleeve with the taper of the sleeve toward the front of the transmission. (9)—Install the forward stop ring. (10)—Next install the steel thrust washer so that it indexes the splines on the mainshaft. (11)—Assemble the 36 rollers in the forward end of the third speed gear, then the spacer with its holes and groove toward the rear of the transmission in such a manner

TRANSMISSION, OVERHAUL

so that the holes are lined up. (12)—Now assemble the other 36 rollers in the rear of the third speed gear, the small steel thrust washer next to the rollers, then the bronze thrust washer.

(13)—After the third speed gear and bearing assembly has been installed on the mainshaft, install the forward bronze thrust washer on the mainshaft with its oil groove to the rear, and then, the steel thrust washer with its tapered face to the front of the transmission. (14)—Install a new snap ring. NOTE—The end play between the steel thrust washer and the snap ring should be from .003" to .009". This end play is obtainable by the availability of several thickness snap rings. (15)—Finally, install the brake support and bearing assembly. CAUTION—This assembly must be pressed on because, if driven on, the end play between the speedometer drive gear and the low speed gear will be disturbed.

MAIN DRIVE GEAR: (1)—If the main drive gear has been disassembled, install the 15 pilot rollers and snap ring in the end of the pinion. (2)—Press the ball bearing on the pinion and install the washer and a new snap ring.

Install the bronze shoes in the synchro-clutch fork. Position the clutch sleeve in the transmission case with the shoes engaging the groove of the sleeve and the tapered end of the sleeve toward the front of the case. Remove the tension spring for the outside lever.

ASSEMBLE: (1)—Install the mainshaft assembly into the case, being sure that the teeth of the third speed gear clutch hub meshes with the center space of each set of teeth in the clutch sleeve, otherwise the sleeve cannot be shifted.

(2)—Install temporarily, two cap screws in the brake support so as to align the mainshaft assembly. (3)—Install the spreader spring and the blocker ring. NOTE—If the clutch sleeve can be pulled all the way over the dogs of the blocker ring, the installation is correct. (4)—Pull the clutch forward over the blocker ring and then, install the main drive gear.

(5)—Raise the countergear assembly in position and install the countershaft from the rear, driving the arbor out through the front of the case at the same time. (6)—Remove the screws which were temporarily installed in the brake support. (7)—Turn the support so as to expose the gearshift rail holes and the reverse idler shaft hole.

(8)—Install the reverse idler gear with its chamfered teeth to the rear of the case, and then, the idler shaft so that the groove in the shaft will line up with the set screw hole which locks it in position.

(9)—Assemble the shift rails and related parts in the reverse order of disassembly, being sure that the rail with the three detent grooves is used for the high and low speed shifting fork. NOTE—When properly installed, the three grooves should be to the rear of the case. When installing the reverse fork and rail, the

spacer should be installed on the rail to the front end of the case, and the two detent grooves to the rear. When replacing the set screws, use the long one for the reverse idler shaft.

(10)—When installing the brake support, the screw with the oil seal should be placed in the lowest hole, and the spacer should be installed in the brake support with its long chamfered position toward the brake drum.

NOTE—With a suitable tool, drive a new oil seal in position, and make sure that the seal protrudes $\frac{7}{32}$ " out of the case. (11)—Install the brake drum, speedometer drive pinion and governor assembly.

(12)—If the shift lever housing has been disassembled, install the tension coil spring in the seat in the shift shaft, and then, with the spring compressed, install the shift shaft and lever. (13)—Insert the pin in the shift lever and install the lock spring, then, replace the shaft set-screw in the housing. (14)—Place the shift rails in neutral and install lever housing pilots in the transmission case, and replace the housing. CAUTION—Make sure that the selector lever enters the shifter fork slots. (15)—Complete the assembly by installing the detent balls, springs and retaining screws.

TROUBLE DIAGNOSIS

Before attempting to make any checks or adjustments, make sure that the accelerator pedal and related linkage are not binding or operating sluggishly. See that the engine idle speed is not adjusted above 4 MPH or 450 RPM, otherwise the automatic change to lower gear ratios will not function properly.

If the accelerator pedal fails to kickdown and the transmission remains in second or fourth gear, it is probably caused by: (1)—Improper adjustment between the vacuum unit stem and the shift lever. This clearance should be $\frac{5}{32}$ ". (2)—Failure in the solenoid circuit. (3)—Failure in interrupter switch circuit. (4)—Improper mechanical function at the transmission or the vacuum unit.

If the kick-down is permanent and the transmission remains in first and third gear, it is probably caused by: (1)—Leaks in the vacuum system. (2)—Engine idling too fast. (3)—Failure in the solenoid circuit. (4)—Improper mechanical function at the transmission or the vacuum unit.

If the shift is sluggish, it may be caused by: (1)—Sticking accelerator linkage. (2)—Engine idling too fast. (3)—Improper dash pot adjustment at carburetor. (4)—Improper mechanical functions at the transmission or the vacuum unit.

If the transmission stays in second or fourth gear when the car comes to a stop, it is due to no automatic down shift and may be caused by: (1)—Improper clearance between the vacuum unit stem and the synchro-clutch lever. (2)—Failure in the governor circuit.

GROUP No. 26

Fig. 83

PACKARD 1935-38, ALL SIXES AND 120'S

BEARING NOISE DIAGNOSIS

CLUTCH PILOT BEARING: Noise not as high pitched as throwout bearing noise but audible only when clutch is fully disengaged.

MAIN DRIVE GEAR BEARING: Noise audible when in neutral with clutch fully engaged and not audible when disengaged with car standing.

MAINSHAFT REAR BEARING: Noise loudest when car is driven in low gear. Not audible with gear-shift in neutral with car standing, regardless of clutch plate position.

MAINSHAFT PILOT BEARING: Usually loudest when idling, but may be confused with noisy reverse idler gear.

DISASSEMBLE

(1)—Take off the transmission cover assembly. **NOTE**—If the cover is to be disassembled, remove the shift fork lock screws and drive the shift rails out through the rear, driving the welch plugs out of the shift rail holes. (2)—Remove the nut and washer from the rear end of the mainshaft. (3)—Pull the transmission flange off the mainshaft. (4)—Remove the speedometer driven gear. (5)—Unbolt the rear bearing retainer and remove it from the case. (6)—Drive the countershaft out rearward, allowing the cluster gear to lie in the bottom of the case. (7)—Take off the main drive gear bearing retainer and tap the main drive gear assembly out through the front. (8)—Tap the mainshaft rearward until its rear bearing is free of the case, and pull the bearing from the shaft. (9)—Tilt the front end of the mainshaft upward and lift out the assembly. (10)—Take the cluster gear out of the case. (11)—Drive the reverse idler shaft out rearward and lift out the gear.

ASSEMBLY NOTES

The countershaft cluster gear should be a free fit in the case with no perceptible end play. Use a tapered dummy countershaft or arbor to facilitate insertion of regular countershaft through the roller bearings. Make sure that the lug on the bronze washer at each end of the countershaft is aligned with corresponding slots in the case before entering the cluster gear.

The main drive gear and universal flange splines should be coated with Lubriplate or equivalent when assembling.

NOTE—The mainshaft with direct drive and second speed stationary gear is serviced as an assembly only and should not be disassembled. The synchronizing clutch and sliding gear is also serviced as an assembly. Should one of any of the mating gears be defective, it will be necessary to replace both as they are lapped at the factory.

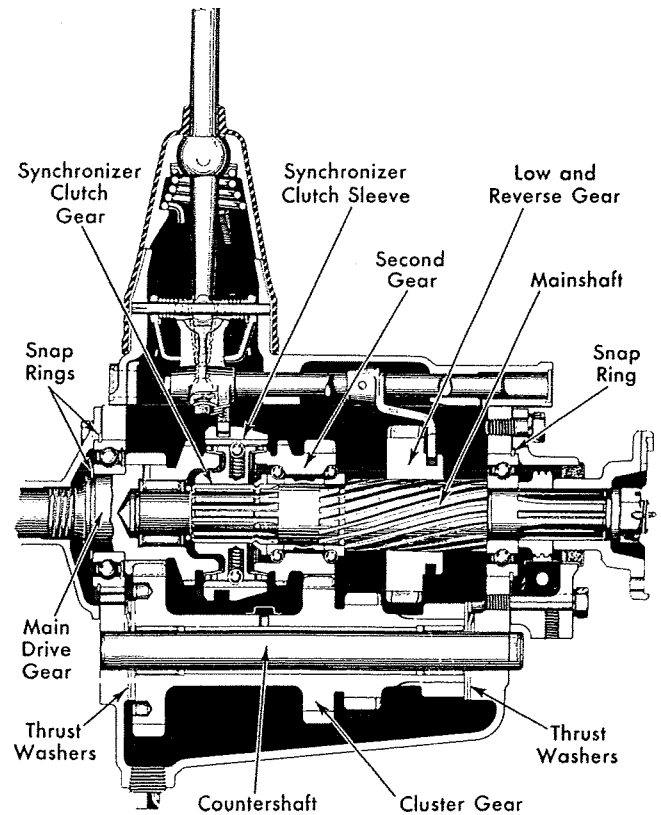


Fig. 83—Group No. 26 Transmission

CAUTION—Do not shift the gears with the cover off as the synchronizer balls and springs will jump out.

ASSEMBLE

REVERSE IDLER: Lay the countershaft cluster assembly in the bottom of the case before installing the idler gear. Hold the idler gear in position in the case and drive the idler shaft in from the rear.

COUNTERSHAFT: The countershaft cluster should be laid in the bottom of the transmission case before installing any of the other parts. Use an arbor or dummy countershaft of the same length as the cluster assembly, and leave it in the cluster until the countershaft is installed. This is done by driving the arbor out with the countershaft, after the mainshaft assembly and clutch shaft have been installed. Be careful to align the lug on the bronze washer at each end of the cluster gear with the corresponding slots in the transmission case.

MAINSHAFT: If the synchronizer assembly was removed from the mainshaft, install it in its original position on the shaft, that is, with the tapered side of the synchronizing clutch sleeve toward the rear. **NOTE**—If the unit was disassembled, a clamping band type ring compressor may be used to assemble the component parts. Install the mainshaft assembly with synchronizer and sliding gears, through the top of the case. Install the rear bearing on the mainshaft.

TRANSMISSION, OVERHAUL

while the shaft protrudes through the rear of the case. Move the mainshaft assembly forward, pressing the bearing into position in the case and install the bearing snap ring.

MAIN DRIVE GEAR: Install the mainshaft pilot bearing in the main drive gear and install the gear and bearing from the front of the case, guiding the pilot bearing over the forward end of the mainshaft. Install a new snap ring in the groove of the front bearing. Replace the front bearing retainer.

NOTE—Complete the assembly in the following manner: Drive the countershaft in from the rear of the case, driving out the arbor which was left in the cluster assembly. Replace the rear bearing retainer and retainer screws. Press the universal joint flange on the mainshaft and replace the retainer washer and nut. Replace the top cover and shifter assembly.

GROUP No. 27

Figs. 84, 85, 86

PACKARD 1939-42 ALL EXCEPT 12'S

NOTE—See Group No. 26 for notes on bearing noise diagnosis.

WITHOUT OVERDRIVE

(1)—Take off the transmission cover. (2)—Remove the nut and washer from the rear end of the mainshaft and pull off the transmission flange. (3)—Remove the speedometer driven gear. (4)—Unbolt the rear bearing retainer and remove it from the case. (5)—Remove the lock plate at the front end of the countershaft and drive the shaft out forward, allowing the cluster gear to lie in the bottom of the case. (6)—Take off the main drive gear bearing retainer and tap the main drive gear assembly out through the front. (7)—Tap the mainshaft to the rear until its rear bearing is free of the case and pull the bearing from the shaft. (8)—Tilt the front end of the mainshaft upward and lift out the assembly. (9)—Take the cluster gear out of the case. (10)—Drive the reverse idler shaft out rearward and lift out the gear.

ASSEMBLY NOTES

Mainshaft with first and second speed constant mesh gears is serviced as an assembly and should not be disassembled.

CAUTION—To prevent the synchromesh balls and springs from jumping out make sure that the clearance between the face of the fork stop lug and the stop on the cover is not more than .010" and not less than .005". If the clearance is more than .010", bend the lug upward. While the same clearance should be maintained on the 1940-42 units, the lock ball is not apt to pop out because the second and high synchronizer clutch gear will butt against the shoulder on the main drive gear on the countershaft cluster, so that it limits the forward travel of the clutch gear,

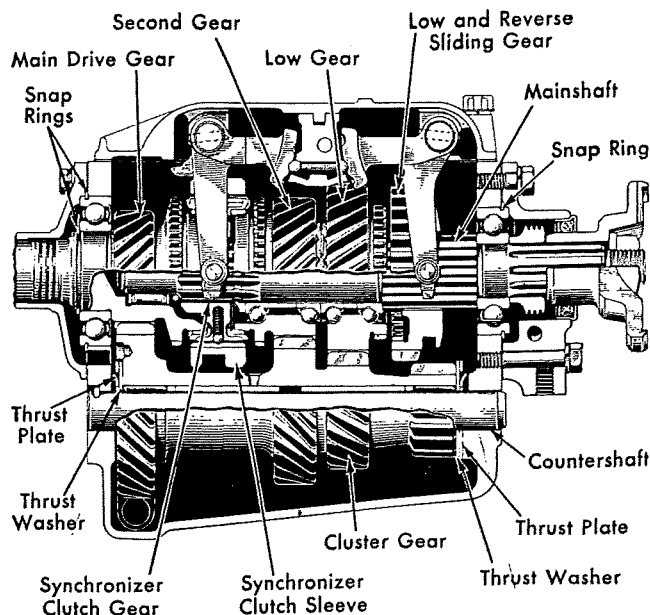


Fig. 84—Group No. 27 Transmission, 1940-42

When installing the synchromesh balls and springs, use a clamping band type ring compressor.

Countershaft cluster should be a free fit without noticeable end play, and should be installed before installing the reverse idler. Use the same tool for installing the countershaft as described for the 1938 cars and follow the same procedure except that it is driven in from the front.

The main drive gear and universal flange splines should be coated with Lubriplate or equivalent when assembling.

ASSEMBLE

REVERSE IDLER: Lay the countershaft gear assembly in the bottom of the case before installing the idler gear. Hold the idler gear in position and drive the idler shaft in from the rear.

COUNTERSHAFT: The cluster gear assembly should lie in the bottom of the case until after the mainshaft and main drive gear is replaced. Then line up the assembly and tap the countershaft in through the front and lock it in position with its lock plate.

MAINSHAFT: See ASSEMBLY NOTES and proceed as follows: Install the assembly in through the top and replace the rear bearing on the mainshaft while the shaft protrudes through the rear of the case. Then move the assembly forward, pressing the bearing in position in the case and install the bearing snap ring.

MAIN DRIVE GEAR: Place the mainshaft pilot bearing in the pocket of the main drive gear and install the gear and its bearing through the front, guiding the pilot bearing over the front end of the mainshaft. Use a new snap ring to hold the front bearing in place. Replace the front bearing retainer.

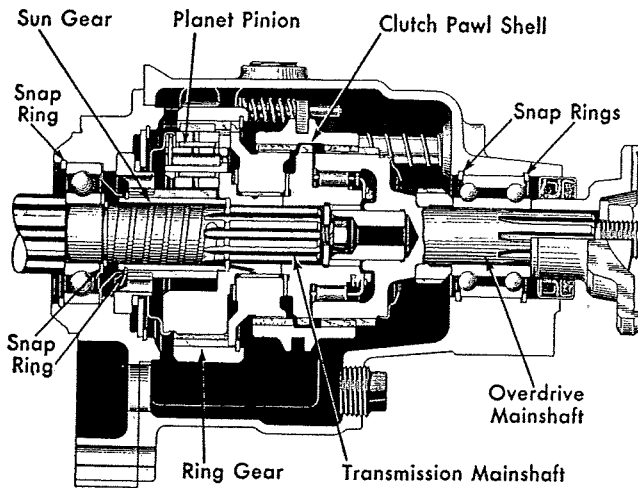


Fig. 85—Group No. 27 Overdrive, 1940-42

NOTE—Complete the assembly by installing the countershaft, rear bearing retainer, transmission flange and its washer and nut. Replace the cover assembly.

WITH OVERDRIVE

DISASSEMBLE: Before proceeding, read the **ASSEMBLY NOTES**. (1)—Remove overdrive drain plug, transmission cover, bearing cap at front of transmission and two short cap screws holding the overdrive adapter plate to the transmission. (2)—Use a drift through the drain plug hole and carefully drive the countershaft forward, stopping as soon as the cluster gear is felt dropping into the case. Leave the bar in the cluster. (3)—Remove main drive gear and synchronizer unit, then pull overdrive assembly, together with the mainshaft assembly, rearward. (4)—Unbolt the adapter plate from the overdrive housing and remove the mainshaft. **NOTE**—Disassemble the overdrive as described under **OVERDRIVE, OVERHAUL**.

ASSEMBLY NOTES: Same as described for 1939-42 cars without overdrive except that the transmission mainshaft should fit into the overdrive adapter plate without noticeable end play. The end play is controlled by the front bearing retaining snap ring, spacer and rear snap ring. These snap rings are available in thickness steps of .003" each.

OVERDRIVE, OVERHAUL

NOTE—The overhaul procedure described below is for 1939 units but also applies in the main to 1940-42 cars. The difference being that the centrifugal clutch unit is not used in 1940-42. The slotted hub which carries the sun gear, together with its sliding pawl and solenoid, has now taken over the function of engaging and disengaging the overdrive which was accomplished in 1939 units by the centrifugal clutch unit.

The overdrive may be removed without removing the transmission, although the necessity for cleanliness makes the removal of the transmission the preferred procedure.

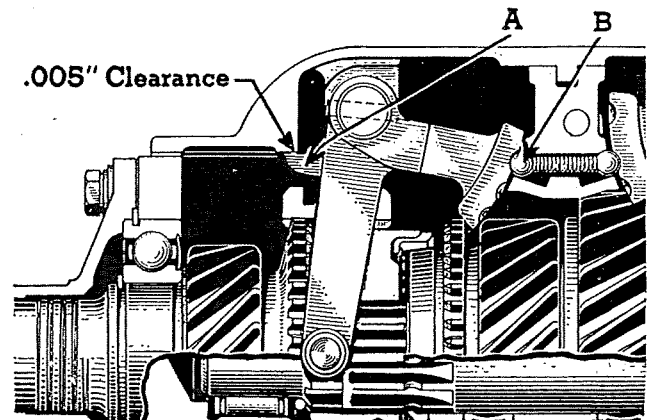


Fig. 86—Group No. 27 1939. Showing clearance between face of fork stop lug "A" and stop on cover in high gear position indicated by "B"

(1)—Remove the screws holding the overdrive case to the adapter plate. **NOTE**—Do not remove bolts holding adapter plate. (2)—Move lock-out lever to the rear as far as possible, then move overdrive case rearward. **NOTE**—The overdrive mainshaft and shifter clutch sleeve will come away with the case, leaving the over-running clutch cam, centrifugal unit (1939) and planetary gears on the transmission mainshaft. (3)—Remove the snap ring which holds the centrifugal unit (1939) and remove the unit. **NOTE**—If the pinion cage will not come off freely, use a puller to remove it, being careful not to bend the oil slinger. (4)—Remove the solenoid plunger pawl by pulling it to the rear and sliding it off the ball. (5)—Disconnect the solenoid. **NOTE**—The adapter plate and sun gear assembly is removed with the transmission mainshaft assembly. However, it is not necessary to remove this assembly unless repairs are made to the transmission.

ASSEMBLY NOTES

On early 1939 model, a collapsible bearing spacer was used between the bearings on the rear of the overdrive mainshaft, which required preloading. This spacer should be replaced with the new solid type which does not require bearing preload. A new type spring washer should also be used when installing this spacer.

To install these bearings, place the speedometer gear on the mainshaft, then with the wide face of the outer bearing race facing toward the splined end of the shaft, press the forward bearing up against the speedometer gear. Place the shaft in the case and install snap rings and new spacer sleeve. Press the second bearing up lightly against the spacer sleeve. Bearings should be installed so that the narrow sides of the inner races face each other. If a new oil seal is required, soak it in engine oil before installing. Install the universal flange, being careful to tighten the self-locking nut only far enough to bring the flange into light contact with the rear bearing. The flange should

TRANSMISSION, OVERHAUL

be a light tap fit on the splines. If loose, install a new one or tin the original with solder.

CLUTCH SLEEVE: Wear on the pawl raceway or windows of the shifter clutch sleeve will produce a rasping noise above 30 MPH, which vanishes when the overdrive is engaged. A worn sleeve should be replaced and when this is done, the centrifugal clutch unit should be replaced also.

CENTRIFUGAL CLUTCH (1939): This unit should be installed without any end play. If end play exists, install a thicker snap ring, which should fit snugly. These snap rings are available in thickness steps of .002". If the pawl faces are burned, scored or worn, replace the entire unit.

PLANETARY PINIONS: Some assemblies are provided with spring-loaded split pinions to prevent gear backlash. If equipped with this type, be sure to wind up the free portion of each pinion until the tooth marks align, before meshing pinions into the ring gear. The amount of wind-up is about $1\frac{1}{2}$ teeth.

SOLENOID PAWL: Check the clearance between the solenoid pawl and the balk ring, which should be .015" with the solenoid in place and energized. Adjust the clearance by adding gaskets under the solenoid unit.

Install the clutch cam and rollers by holding the rollers in place with cup grease and a tight-fitting rubber band. Late models do not require this procedure. Turn the low point of the cam to the top. Insert the clutch sleeve to the case with the windows to the front and finger engaged in slot. Be sure to install the reverse lock-out rod.

NOTE—On second type units, the overdrive mainshaft and front bearing assembly is assembled to the clutch first, then the clutch sleeve and case, front snap ring, spacer, spring washer, rear snap ring and rear bearing in that order, without using a rubber band to hold the rollers. These late units are stamped "M" on the universal flange.

GROUP No. 28

Figs. 87, 88

NASH 1935-38 PARTIAL "NASH" TRANSMISSION WITHOUT OVERDRIVE

NOTE—When ordering parts for any transmission, order by the number on the plate attached to the side of the transmission.

(1)—After removing the transmission cover, remove the rear cover over the shifter rods. (2)—Take off the universal joint flange and the rear bearing retainer. (3)—Tap the mainshaft rear bearing out through the rear of the case. (4)—Lift the mainshaft assembly together with the sliding gears and synchronizer mechanism out through the top of the case. (5)—Remove the drive gear bearing retainer and bearing. (6)—Unbolt the clamp screw and lock at the rear of

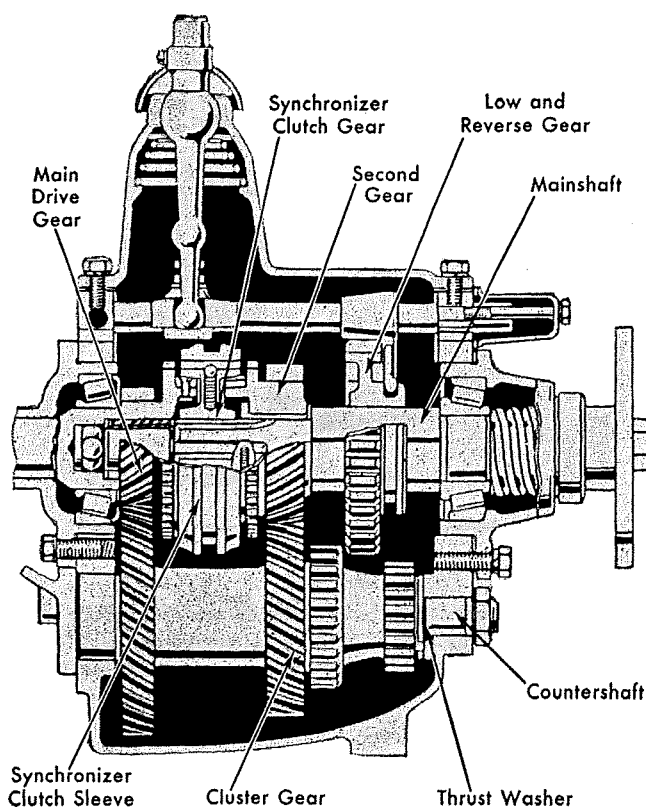


Fig. 87—Group No. 28 Transmission

the countershaft, and the cap at the front. (7)—Drive the countershaft out through the front of the case. (8)—Remove the reverse idler gear shaft and idler gear.

MAINSHAFT: To disassemble, remove the key and thrust washer between the synchronizing clutch and the second speed clutch gear, and remove the gears from the mainshaft.

SYNCHRONIZER: **NOTE**—Before disassembling this unit, mark the relationship of the clutch sleeve with the clutch gear so that, if disassembled, assembly may be made in the same relative position.

To disassemble the unit, wrap a cloth around the assembly to avoid losing the balls and springs; then separate the clutch sleeve from the gear.

NOTE—To assemble the unit, apply a liberal quantity of grease in the holes in the clutch gear, and also to the balls and springs. Position the balls and springs in the clutch gear. Use a clamp—similar to a ring compressor—to compress the assembly enough to enable the sleeve to be installed.

CAUTION—When replacing the synchronizer assembly on the mainshaft, the side marked "Front" should be placed toward the front.

ASSEMBLE

COUNTERSHAFT: Drive the shaft in from the front toward the rear. Precaution must be taken to

TRANSMISSION, OVERHAUL

insure the correct positioning of the bronze and steel thrust washers and their location on the dowels indicated to retain them. The bronze washers are located between gears and steel washers. The clamp screw at the end may be temporarily inserted to insure location of the rear steel thrust washer.

MAIN DRIVE GEAR: Insert the main drive gear including shims, thrust washer, pilot bearing, roller bearing, and oil shedder through the top of the transmission.

MAINSHAFT: The second speed gear must be a running fit. The end movement of this gear should not exceed .008". This clearance is controlled by the thickness of the thrust washer. After the thrust washer is driven in place, the key is installed, locating the thrust washer in a position where the splines retain it in place. In applying the synchronizer assembly, note that the side toward the front of the transmission is marked FRONT. Also, that one missing tooth in the hub must be applied on the spline shaft in line with the thrust washer retaining key. Insert the mainshaft assembly toward the rear of the transmission, then forward, entering its front end in pilot bearing.

The front bearing cap containing the oil seal should be installed next and securely bolted in place. Then, holding the mainshaft from contact with the countershaft, carefully drive the rear bearing cone and rollers on the mainshaft. Install the speedometer gear with counterbored end towards the front, and the bearing cap, with the necessary shims to adjust the bearing to freedom, without appreciable looseness.

WITH OVERDRIVE

This unit is serviced in exactly the same manner as described for the "Nash" transmission without overdrive, therefore only the overdrive will be described.

OVERDRIVE, OVERHAUL

1935-36 SERIES 20 AND 80

NOTE—It is not necessary to dismantle the transmission if only the overdrive is to be serviced. Merely detach the overdrive housing from the transmission case and pull the overdrive assembly straight back, disengaging the overdrive shaft from the transmission mainshaft.

DISASSEMBLE

(1)—Pry the shift collar lock ring out of the groove in the overdrive shaft at the front. (2)—Remove the cap screws from the rear bearing retainer and pull the retainer, together with the tail shaft and free wheel assembly out through the rear of the housing. (3)—Remove the clutch, the pinion cage assembly and the mainshaft from the rear of the housing. (4)—Unbolt the cap screws which fasten the sun gear and damper assembly to the housing and lift out the damper assembly.

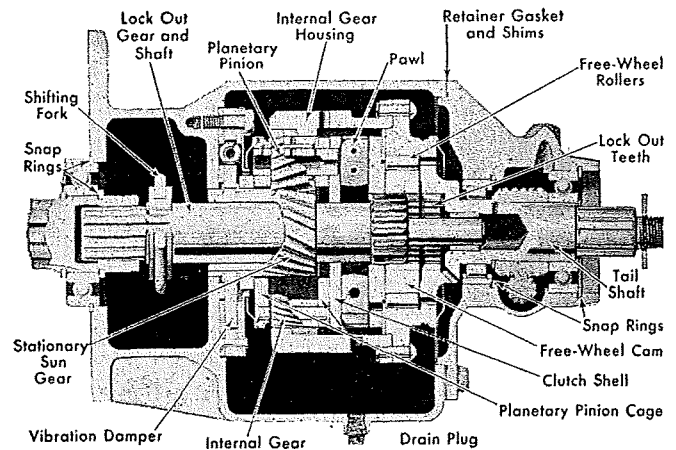


Fig. 88—Group No. 28 Overdrive on 1935-36 Series 20 and 80

(5)—To remove the tail shaft and free wheel from the rear bearing retainer, press the shaft out forward.

(6)—Take off the lock ring and pull the oil seal and bearing out through the rear.

(7)—If necessary to disconnect the shift mechanism, unhook the control lever spring and remove the clevis pin from the control lever shaft. (8)—Detach the horse shoe lock from the rear of the shift fork by pushing the rod spring and cup forward—which will release the lock from the groove in the shift rod. (9)—Take out the rod from the forward end of the housing and lift out the rod spring and shift fork.

ASSEMBLE

NOTE—Reverse the order of the above procedure to assemble the unit and always use new snap rings and lock washers. However, to control the end play between the rear bearing retainer and the overdrive housing, replace the rear bearing retainer, together with the free wheel and tail shaft assembly without using any shims or gasket. Install the two top screws in the retainer and run them up FINGER TIGHT. Now measure the clearance between the gasket faces of the housing and the retainer—using a feeler gauge. To this measurement, add not less than .015" of shims. The total measurement thus obtained indicates the thickness of shims to be installed between the housing and the retainer.

OVERDRIVE, OVERHAUL

1937-38 ALL

NOTE—Although this transmission is constructed the same as the unit without overdrive, the manner in which the transmission and overdrive assemblies are connected necessitates the disassembly of the overdrive before repairs on the transmission can be performed. However, after the overdrive has been re-

TRANSMISSION, OVERHAUL

moved, the same procedure should be followed in servicing the transmission as already described for these cars without overdrive.

DISASSEMBLE: (1)—Lock the transmission in two gears and take off the overdrive mainshaft flange nut. (2)—Use a puller to remove the transmission flange. (3)—Remove the speedometer pinion. (4)—Detach the overdrive housing from the transmission case and withdraw the overdrive housing rearward, using care not to lose any of the free wheel rollers as they fall. (5)—Use a brass drift to drive the overdrive mainshaft from the housing. (6)—Work the overdrive shifting arm and take out the shifting sleeve from the housing. (7)—The free wheel cam and cage assembly may now be removed after taking off the locking screw. (8)—Remove the Oilite washer (if equipped) from the face of the free wheel cam. **NOTE**—When installed, the chamfered side of this washer should face toward the front. (9)—Remove the overdrive ring gear from the pinion cage assembly.

OVERDRIVE RING GEAR & CLUTCH: (1)—Remove the snap ring from the rear of the ring gear. (2)—Lift out the overdrive clutch assembly. (3)—Use an arbor press to remove the plain bearing from the clutch and when performing this operation, use a plug which is exactly the same size as the bearing. (4)—Take out the clutch pawl adjusting screws. **NOTE**—When removing these screws, it is important to count the number of half turns so that when they are replaced, the original cut-in speed of the overdrive is retained. Each half turn of the screw is indicated by a click.

SUN GEAR & PINION CAGE: (1)—Take off the washer from the rear of the pinion cage assembly. (2)—Slip off the pinion cage assembly by rotating it from the sun gear. (3)—Remove the screws which fasten the adapter plate to the transmission case. (4)—After lifting off the transmission shift rails, slide the mainshaft assembly together with the adapter plate and sun gear, out through the rear. (5)—Take off the snap ring from the rear of the sun gear. (6)—Remove the snap ring from the adapter plate at the front of the transmission mainshaft rear bearing. (7)—The sun gear and adapter plate may now be pressed off the mainshaft.

NOTE—At this point, repairs to the transmission may be made and the procedure as given for these cars **WITHOUT OVERDRIVE** should be closely followed.

OVERDRIVE, ASSEMBLE: Reverse the order of disassembly to assemble the unit but observe the following: (1)—Be sure to install a gasket on each side of the adapter plate. (2)—When replacing the free wheel rollers, use cup grease to hold them in position while replacing the overdrive mainshaft. A very light rubber band may also be used for this purpose. (3)—When the clutch pawls are assembled, lock them in the engaged position—flush with the forward face of the overdrive clutch—then remove the locking pieces from

the pawls. (4)—Install the sliding sleeve into the overdrive case, being sure to make the proper connection between the shifter collar and groove. Work the overdrive housing into position by starting it upside down until the lock-out rod is touching the adapter plate. Now, carefully rotate the overdrive housing into its correct position and complete the assembly. **NOTE**—If the housing will not go all the way readily, work the lockout lever. When the assembly is completed, make sure that all parts turn freely.

FREE WHEEL, OVERHAUL, 1935

With the free wheel assembly removed from the transmission as already described in the **TRANSMISSION OVERHAUL** chapter, proceed as follows:

(1)—Pry the roller retaining snap ring out of the groove in the free wheel outer case. (2)—Remove the roller retainer and invert the free wheel assembly, jarring it on a block of wood to remove the rollers. (3)—Remove the free wheel spider, roller shoes and springs.

(4)—To remove the free wheel from its housing, take out the speedometer driven gear, unscrew the nut from the end of the free wheel shaft and pull off the universal flange, the speedometer gear and spacer. (5)—The shaft may now be pressed from the housing. (6)—To remove the bearing from the housing, take off the snap ring and press out the bearing.

NOTE—Reverse the procedure to assemble the unit and replace the rollers and related parts in the following manner. (a)—Install the spider in the clutch sleeve. (b)—Install a roller shoe and spring. (c)—Using a small screwdriver, press the shoe against the spring and insert a roller; repeating this procedure until all rollers, shoes and springs are installed. (d)—Replace the roller retainer and lock in position with a snap ring. (e)—Make sure that the free wheel shaft front bearing is in its pocket at the rear of the transmission mainshaft. (f)—Install the unit to the transmission by rotating the free wheel shaft slightly (if necessary) to engage the splines of the transmission mainshaft.

GROUP No. 29

Fig. 89

AUBURN 8, 1935-36. GRAHAM 1935, 72, 73, 75; 1936, 90, 110; 1937, 116, 120; 1938-40 ALL. HUPMOBILE 1938-39 ALL. NASH "400," 1936 PARTIAL. REO 1936. STUDEBAKER 1936-38 ALL AND 1939 COMMANDER WITH FLOOR SHIFT.

WITHOUT OVERDRIVE

SHIFT MECHANISM: (1)—Remove the shift rail retainer screws and lift out the shift rail and fork assemblies. **NOTE**—Take out the balls and springs from the front end of the case under the shift rails.

MAINSHAFT (2)—Lock the transmission in two gears to prevent the mainshaft from turning and, using a suitable puller, take off the transmission companion flange and brake drum assembly (if equipped). (3)—Withdraw the mainshaft from the rear of the case, being careful not to damage the synchronizer.

(4)—Before disassembling the mainshaft, mark the relationship of the synchronizer clutch sleeve with the clutch gear so that, if disassembled, assembly may be made in the original position.

(5)—Slip the synchronizer from the mainshaft. (6)—Remove the second speed gear by using a suitable pointed tool through a hole in the second speed gear thrust washer and depress the spring plunger. (7)—Turn the washer until its splines align with the grooves on the mainshaft, after which, the washer and second speed gear can be removed from the shaft.

NOTE—After installing the second speed gear, check its end play by inserting a feeler gauge between the back face of the gear and the butt end of a spline on the mainshaft. End play should be from .003" to .008" and if not within these limits, thrust washers of several thicknesses are available to obtain this clearance.

SYNCHRONIZER: (8)—To disassemble this unit, wrap a cloth around the assembly to avoid losing the balls and springs; then separate the clutch sleeve from the gear.

NOTE—To assemble the unit, apply a liberal quantity of grease in the holes in the clutch gear, and also to the balls and springs. Position the balls and springs in the clutch gear. Use a clamp—similar to a ring compressor—to compress the assembly enough to enable the sleeve to be installed.

CAUTION—When replacing the synchronizer assembly on the mainshaft, be sure that the hub portion of the gear and the straight portion of the sleeve are toward the front.

MAIN DRIVE GEAR: **NOTE**—Before this assembly can be removed, the countershaft must be driven out, allowing the countergear cluster to lie in the bottom of the case. See the **COUNTERSHAFT** paragraph.

(9)—Take off the main drive gear bearing retainer and, after removing the snap ring, pull the main drive gear assembly out rearward.

NOTE—Before installing the gear, be sure to place the countergear assembly in the bottom of the case, but **DO NOT** install the countershaft until after the main drive gear is in position.

COUNTERSHAFT: (10)—Remove the countershaft locking plate and, using a dummy shaft (or arbor) to hold the needle bearings in place, drive the shaft out rearward, allowing the countergear assembly to lie in the bottom of the case until the main drive gear is removed—as already explained.

NOTE—To install the assembly: (a)—Insert the

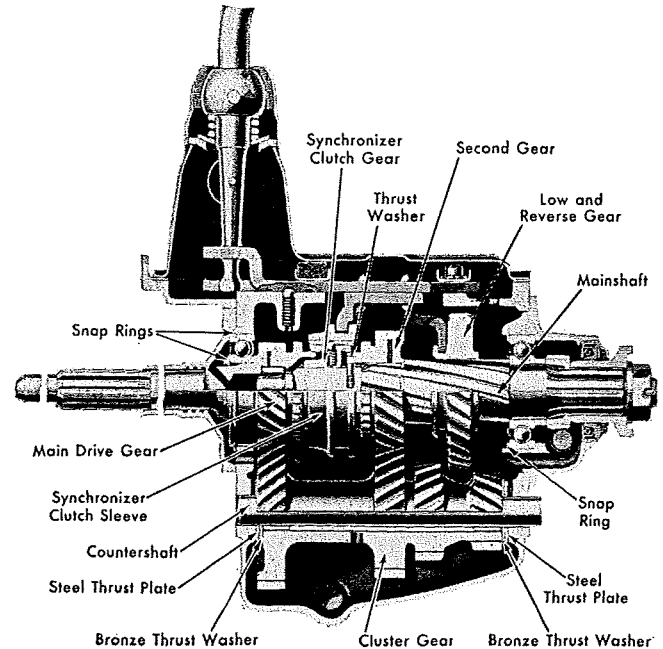


Fig. 89—Group No. 29 Transmission

bearing spacer into the gear and then, install the dummy shaft (or arbor) which was used when removing the assembly. (b)—Apply a liberal amount of cup grease at each end of the gear and insert the needle bearings. (c)—After the needle bearings are properly inserted, place a steel thrust plate at each end of the gear, and a bronze thrust washer at each end of the assembly, using cup grease to hold them in position. (d)—Place the entire assembly into the case and, before installing the regular countershaft, replace the main drive gear assembly. (e)—Position the countergear assembly and drive the dummy shaft out by installing the regular countershaft through the rear.

NOTE—The end play of the countershaft should be from .002" to .008" and can be checked by forcing the assembly toward the front. Then insert a feeler gauge between the thrust washer and the case at the rear. Thrust washers are available in several thicknesses to obtain this clearance.

REVERSE IDLER: Lift the reverse idler out of the case after driving the shaft out through the rear.

ASSEMBLE: Reverse the order of removal to assemble the transmission. To insure a proper fit in their grooves, snap rings which have been removed should be replaced with new ones.

WITH OVERDRIVE

NOTE—If repairs are to be made on the overdrive **ONLY**, it is not necessary to dismantle the transmission unless the sun gear or adapter plate is to be replaced.

(1)—Take off the nut from the end of the overdrive tail shaft. (2)—Use a puller to remove the flange and brake drum assembly. (3)—Remove the speedometer

TRANSMISSION, OVERHAUL

pinion. (4)—Unbolt the overdrive case from the transmission case and slide the overdrive case rearward. NOTE—It may be necessary to tap the end of the overdrive shaft lightly to prevent the internal parts from coming away with the case.

(5)—Hold one hand under the free wheel roller retainer to catch the rollers as the overdrive tail shaft is pulled rearward. (6)—The free wheel retainer and hub bushing can now be slipped off after first removing the retaining cap screw. (7)—Disengage the ring gear and clutch assembly from the pinions. NOTE—If necessary to remove the clutch from the ring gear, mark the relationship of these parts so that installation may be made in the original position; then remove the snap ring which holds these parts together.

(8)—Slide off the pinion cage thrust washer and remove the pinion assembly from the shaft. (9)—Take off the adapter plate snap ring and thrust plate. (10)—Release the snap ring which retains the sun gear, after which, the sun gear and blocker assembly can be removed from the shaft.

NOTE—At this point, if repairs are to be done to the transmission, proceed as already described for these cars without overdrive. And, if it is necessary to remove the overdrive control parts from the overdrive case, proceed as follows, paying particular attention to the arrangement of the parts.

(11)—Loosen the lock screw and take out the overdrive shift control lever, after which, the overdrive shift control lever and shaft may be removed. (12)—To remove the overdrive shift yoke, back out the lock screws, remove the plug, and loosen the retaining screw which will permit the removal of the shift shaft, fork and spring.

ASSEMBLE: Reverse the general order of procedure to assemble the unit, paying particular attention to the following remarks.

If the clutch pawl adjusting screws have been removed, they should be installed so that each screw receives the same number of turns to provide equal tension on the springs. As these springs control the cut-in speed of the overdrive both pawls should engage at the same time. The tighter these screws are turned, the higher will be the cut-in speed.

Wear on the pawl raceway or windows of the clutch sleeve produces a rasping noise at speeds above 30 MPH—which vanishes when the overdrive is engaged. A worn sleeve should be replaced, and when this is done, the clutch unit should also be installed.

When installing the free wheel rollers, use a rubber band to hold them in position.

If the reverse plunger has been removed, be sure to install it in the overdrive housing with the long portion of its small diameter to the front.

Some assemblies are provided with spring-loaded split planetary pinions. If equipped with this type, be

sure to wind up the free portion of each pinion before meshing the pinions with the ring gear. The amount of wind-up is about $1\frac{1}{2}$ teeth.

GROUP No. 30

Fig. 90

GRAHAM 1935, 74; 1936, 80, 80A, 90A;

1937, 85, 95

WILLYS 1937-39 ALL AND 1940 SPEEDWAY
WARNER T84

DISASSEMBLE

(1)—Take off the transmission cover. (2)—Remove the shift rail retainer screws and lift out the shift rail and fork assembly, being sure to collect the poppet balls and springs. (3)—Lock the transmission in two gears to prevent the mainshaft from turning and remove the bolt from the end of the mainshaft. (4)—Use a puller if necessary, to take off the universal flange and brake drum (if equipped). (5)—Remove the speedometer driven gear and disconnect the mainshaft rear bearing retainer from the case. (6)—Remove the lock plate and drive the countershaft out through the rear, allowing the cluster gear to lie in the bottom of the case. (7)—Remove the main drive gear bearing retainer and pull the gear and bearing assembly out through the front. (8)—Tap the mainshaft toward the rear until the rear bearing is clear of the case and pull off the bearing. (9)—Lift the mainshaft and gear assembly out through the top. (10)—Remove the countershaft gear assembly out of the transmission. (11)—Drive the reverse idler shaft out rearward and lift out the gear.

MAINSHAFT: To disassemble, slip the synchronizer and low speed sliding gear from the mainshaft. Use a pointed tool to push the lock plunger down to permit the second speed gear thrust washer to be turned so that its splines align with the grooves on the mainshaft, after which, the washer and gear may be removed.

SYNCHRONIZER: Before disassembling the unit, mark the relationship between the clutch gear and the sleeve so that assembly may be made in the original position. Wrap a cloth around the assembly to avoid losing the balls and springs and push the gear out of the sleeve.

NOTE—To assemble, apply a liberal quantity of grease in the holes in the clutch gear and install the balls and springs. Use a piston ring compressor-type clamp to compress the assembly enough to slide the clutch sleeve in position.

ASSEMBLE

(1)—Assemble the reverse idler gear by driving the shaft in through the rear. (2)—Place the countershaft gear assembly in the bottom of the case, using grease to hold the thrust washers in place. (3)—Assemble the mainshaft gears in the reverse order of removal and install the assembly in the case. (4)—Replace the main-

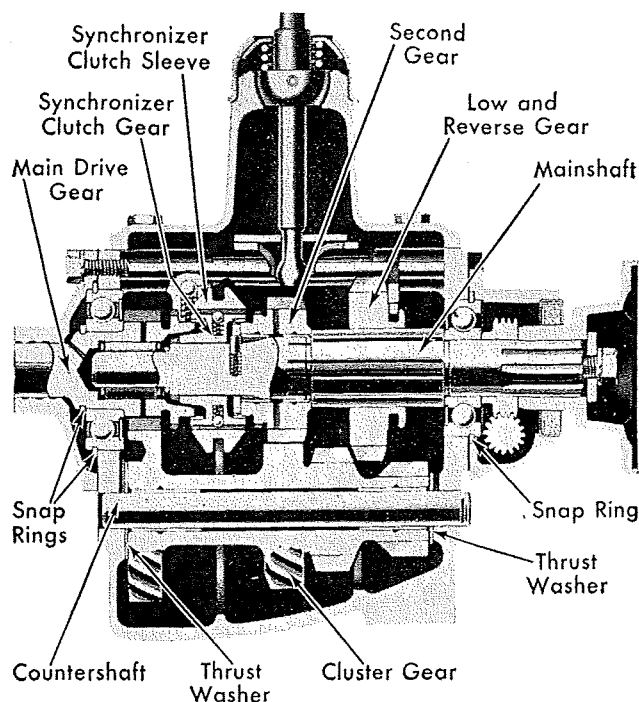


Fig. 90—Group No. 30 Transmission

shaft rear bearing, speedometer drive gear and sleeve. (5)—Attach the rear bearing retainer to the case and install the universal flange and brake drum (if equipped). (6)—Install the bolt and washers to the rear of the mainshaft. (7)—Replace the main drive gear and bearing assembly through the front and attach the bearing retainer. (8)—Align the countergear assembly and drive the countershaft in through the rear, locking the idler shaft and countershaft in position with the lock plate and bolt. (9)—Assemble the shifter mechanism and replace the cover.

GROUP No. 31

NASH 1939-40 ALL; 1941-42 SERIES 60 & 80

WITHOUT OVERDRIVE

COUNTERSHAFT: (1)—Remove the bearing cap and oil seal at the front end of the countershaft. (2)—Drive the countershaft out through the front, allowing the cluster gear to lie in the bottom of the case.

SHIFTER MECHANISM: NOTE—1939-40 cars: (3)—Disconnect the two shifter operating levers from the top of the transmission cover and take off the cover. CAUTION—To avoid disassembling the interlock and speed finders, install a large nut or spacer over the upper end of each shift shaft and screw on the original nuts. (4)—Straighten the metal lock plates on the shift fork studs and remove the nuts from these studs. (5)—Lift the shift mounting plate and shift

shafts out of the case. (6)—Remove the shift forks, being careful not to drop the shoes into the case.

NOTE—1941-42 cars: (a)—Without removing the shift levers from the outside of the case, drive out the shift shaft bushing retaining pins from below. (b)—Remove the plug from the front face of the transmission case. (c)—Use a suitable tool through this hole and work the second and high shift shaft outward. NOTE—Be sure to retain the second and high speed plunger in place so it will not drop into the case. (d)—Repeat this operation on the first and reverse shaft, after which, the plunger and spring may be removed. (e)—With both shift shafts toward the outside of the case, remove both shift forks out through the top.

NOTE—It is not necessary to disturb the speed finder locating screw which is locked in place by a nut on the outside of the case between the shift levers. When properly adjusted, there should be no bind between its inner end and the flats on the plungers.

MAINSHAFT: (7)—Remove the cap screw and washers and pull off the transmission companion flange. (8)—Disconnect the mainshaft rear bearing retainer and oil seal assembly. (9)—Withdraw the mainshaft assembly through the rear.

NOTE—To disassemble: (a)—Use a pointed tool to depress the plunger which holds the splined retainer in place in front of the synchronizer. (b)—Turn the retainer one spline and slip it from the shaft. (c)—Remove successively, the synchronizer unit, thrust washer, second speed gear, thrust washer, low speed gear and on 1939-40 cars, the low and reverse gear shift collar.

MAIN DRIVE GEAR: (10)—Remove the main drive gear bearing retainer and tap the main drive gear out through the front.

NOTE—To disassemble: (a)—Remove the snap ring which retains the mainshaft pilot roller bearings and take the rollers out of the pocket of the main drive gear. (b)—Release the main drive gear bearing snap rings and press the bearing from the shaft.

SYNCHRONIZER

SEVEN-BALL RETAINER TYPE: Before disassembling, mark the relationship of the clutch gear with the sleeve so that assembly may be made in the same relative position.

To disassemble, wrap a cloth around the assembly to avoid losing the balls and springs, then push the clutch gear out of the sleeve.

NOTE—To assemble the unit, apply a liberal quantity of grease to the holes in the clutch gear and also to the balls and springs. Place the balls and springs in position in the clutch gear and, using a clamp—similar to a piston ring compressor—compress the assembly enough to enable the sleeve to be installed.

TRANSMISSION, OVERHAUL

CAUTION—When replacing on the mainshaft, be sure the tapered side of the sleeve faces the front.

THREE-BALL RETAINER TYPE: Follow instructions as described above for the seven-ball type but when assembling, place the balls, springs and shifting plates in position and compress the assembly in the same manner as already described, then install the sleeve.

ONE SPRING RETAINER TYPE: Push the gear out of the sleeve and take out the spring and shifting plates.

To assemble, position the shifting plates in the clutch gear cut-outs and install the spring over the gear and into the grooves of the shifting plates. The assembly may then be installed in the sleeve, being sure that the spring is positioned properly in the groove of the sleeve.

TWO SPRING RETAINER TYPE: Take the synchronizer rings from the assembly and slip the sleeve from the gear, being careful not to lose the shifting plates. Remove the snap rings from the gear.

To assemble, position the shifting plates in the clutch gear cut-outs and install the assembly into the sleeve. Replace the snap rings, being sure the shifting plates are positioned properly.

ASSEMBLE

REVERSE IDLER: Install the reverse idler gear with its shoulder to the front of the case and drive the shaft in through the rear with the key in line with the notch in the case.

COUNTERSHAFT: Install the countershaft assembly in the case with the dummy shaft in place using cup grease to hold the thrust washers in position. Do not install the regular countershaft until after the mainshaft assembly is installed. Make sure that the projections on the countershaft thrust washers align with the notches above the shaft holes in the case.

MAIN DRIVE GEAR: When installing the main drive gear assembly, saturate the oil seal before installation. Make sure that sufficient gaskets are installed to retain the main drive gear bearing snap ring firmly against the front of the case without any clearance between the retaining cap and the case.

MAINSHAFT: To locate the synchronizer properly on the mainshaft, shims are used between the mainshaft rear bearing retainer and the transmission case. With the shims in place and the retainer tightened securely, the end play of the front bronze synchronizer ring should be .020" on 1939, .010" on 1940 and .015" on 1941-42 units.

WITH OVERDRIVE

Remove the universal joint flange and loosen the screws holding the overdrive case to the transmission. Draw the overdrive case slowly to the rear and, at the

same time, drive the overdrive tail shaft forward to prevent disassembly of the free wheel clutch. Be sure to separate the overdrive case from the rear bearing retainer. Should the retainer move toward the rear $\frac{1}{4}$ ", the synchronizing clutch will become disassembled. This is important, especially if the transmission requires no repairs.

If both the transmission and overdrive assemblies are to be dismantled, the shift mechanism should be removed first, then, disassemble the overdrive assembly and finally the transmission assembly.

The balance of the overhaul procedure is the same as described for these cars without overdrive. See **OVERDRIVE, OVERHAUL** for repairs on this unit.

OVERDRIVE, OVERHAUL

NOTE—If repairs are to be made on the overdrive **ONLY**, it is not necessary to dismantle the transmission.

(1)—Take off the overdrive rear bearing retainer. (2)—Use suitable spreader pliers to release the snap ring which retains the rear bearing. (3)—Remove the speedometer pinion. (4)—Unbolt the overdrive case from the transmission case and slide the overdrive case rearward. **NOTE**—It may be necessary to tap the end of the overdrive shaft lightly to prevent the internal parts from coming away with the case.

(5)—Hold one hand under the free wheel roller retainer to catch the rollers as the overdrive tail shaft is pulled rearward. (6)—The free wheel retainer and hub bushing can now be slipped off after first removing the retaining cap screw. (7)—Disengage the ring gear and clutch assembly from the pinions. **NOTE**—If necessary to remove the clutch from the ring gear, mark the relationship of these parts so that installation may be made in the original position; then remove the snap ring which holds these parts together.

(8)—Slide off the pinion cage thrust washer and remove the pinion assembly from the shaft. (9)—Take off the adapter plate snap ring and thrust plate. (10)—Detach the solenoid from the adapter plate and remove the solenoid pawl and plunger. (11)—Release the snap ring which retains the sun gear, after which, the sun gear and blocker assembly can be removed from the shaft.

NOTE—At this point, if repairs are to be done to the transmission, see the **TRANSMISSION, OVERHAUL** chapter for instructions. And, if it is necessary to remove the overdrive control parts from the overdrive case, proceed as follows, paying particular attention to the arrangement of the parts.

(12)—Loosen the lock screw and take out the overdrive shift control lever, after which, the overdrive shift control lever and shaft may be removed. (13)—To remove the overdrive shift yoke, back out the lock screws, remove the plug, and loosen the retaining screw which will permit the removal of the shift shaft, fork and spring.

ASSEMBLE

Reverse the general order of procedure to assemble the unit, paying particular attention to the following remarks.

If the clutch pawl adjusting screws have been removed, they should be installed so that each screw receives the same number of turns to provide equal tension on the springs. As these springs control the cut-in speed of the overdrive both pawls should engage at the same time. Therefore, the screws should be turned in until the top of the screw heads are exactly $\frac{1}{16}$ inch below the top edge of the counterbore. The tighter these screws are turned, the higher will be the cut-in speed.

Wear on the pawl raceway or windows of the clutch sleeve produces a rasping noise at speeds above 30 MPH—which vanishes when the overdrive is engaged. A worn sleeve should be replaced, and when this is done, the clutch unit should also be installed.

The clearance between the solenoid pawl and the balk ring should be .015" with the solenoid in place and energized. Adjust the clearance by adding gaskets under the solenoid unit.

When installing the free wheel rollers, use a rubber band to hold them in position and install the free wheel rollers in position. Install the free wheel cam hub bushing and tongued washer—with the tongue toward the cam—and replace the retaining cap screw securely.

When assembling the planetary pinions in the internal gear, the split pinions must be turned so that the teeth of the large gears pass $1\frac{1}{2}$ teeth of the small gears.

If the reverse plunger has been removed, be sure to install it in the overdrive housing with the long portion of its small diameter to the front.

GROUP No. 32

Figs. 91, 92, 93, 94

CHEVROLET TRUCK 1931-42 ALL MODELS USING FOUR-SPEED TRANSMISSION AND TORQUE TUBE DRIVE

DISASSEMBLE

(1)—Remove the transmission cover assembly and place the transmission in low and second gears to prevent the mainshaft from turning. (2)—Remove the speedometer driven gear. (3)—Take off the cap screw from the rear of the mainshaft and slip off the universal joint. (4)—Disconnect the universal ball retainer from the transmission. (5)—Remove the main drive gear bearing retainer and tap the main drive gear out through the front. (6)—Slip the mainshaft pilot bearing from the front end of the mainshaft and tap the mainshaft to the rear until the rear bearing is clear of the case. (7)—Grasp the sliding gears and withdraw the mainshaft out through the rear and lift out the

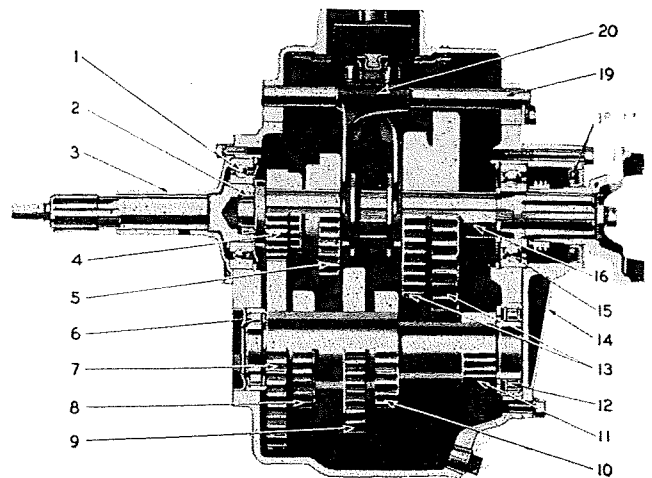


Fig. 91—Group No. 32 Transmission

- | | |
|-----------------------------|---------------------------|
| 1—Drive gear bearing | 11—Low speed drive gear |
| 2—Mainshaft pilot bearing | 12—Bearing |
| 3—Bearing retainer | 13—Low and second gear |
| 4—Main drive gear | 14—Rear bearing retainer |
| 5—High speed sliding gear | 15—Rear bearing |
| 6—Bearing | 16—Mainshaft |
| 7—Countershaft drive gear | 17—Universal joint flange |
| 8—Countershaft reverse gear | 18—Oil seal |
| 9—Countershaft third gear | 19—Shifter shaft |
| 10—Countershaft second gear | 20—Shifter forks |

sliding gears through the top. (8)—Drive the reverse idler shaft out toward the rear and lift out the gear assembly. (9)—Drive the countershaft toward the rear until the rear bearing and its retainer is free of the case. (10)—Slip the bearing and retainer from the shaft and lift out the countergear assembly. (11)—Tap the countershaft front bearing out by using a soft drift against its outer race.

ASSEMBLY NOTES

REVERSE IDLER: If clearance between bushing and shaft exceeds .002"-.004" the gear and bushing assembly should be replaced to assure proper alignment of bushings and correct meshing with mating gears.

COUNTERGEARS: With the exception of the low speed gear—which is integral with the countershaft—the gears may be replaced and when installed on the shaft, be sure all four keys between the shaft and the gears are staked in place with a prick-punch.

SHIFTER MECHANISM: If required, the shift plate and fork assembly is replaced as a unit after cutting off the four rivets holding it in place.

If the shift shafts have been removed, the shaft with the three equally spaced notches should go in the central position; the one with the three unequally spaced notches belongs at the left (cover inverted), and the reverse shaft—with two notches—belongs at the right.

To assemble the shift forks, place the plunger spring in the fork and install the plunger ball. Using an old

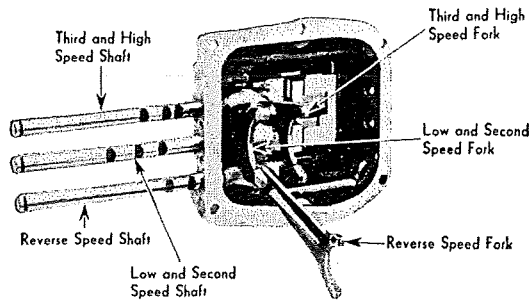


Fig. 92—Group No. 32 Shift Mechanism

shifter shaft with a notch ground in its end, force the ball down on the spring, using the ground tool as a guide to push the regular shaft into place.

ASSEMBLE

(1)—Position the countershaft front bearing and retainer in place, being sure that the bearing is flush with the front face of the case. (2)—Place the countershaft assembly in position and install the rear bearing and thrust washer, placing the thrust washer against the gear.

NOTE—To check the countershaft end play, assemble the universal ball retainer and its gasket to the case temporarily. Force the countershaft back as far as possible and check the clearance between the front bearing and the gear. If the clearance exceeds .015", install a shim of the required thickness between the front bearing and its retainer. With the proper end play established, remove the universal ball retainer and gasket and go on with the assembly.

(3)—Install the idler gear, placing the small gear toward the rear and drive the idler shaft into position from the rear of the case. NOTE—The flat spot on the

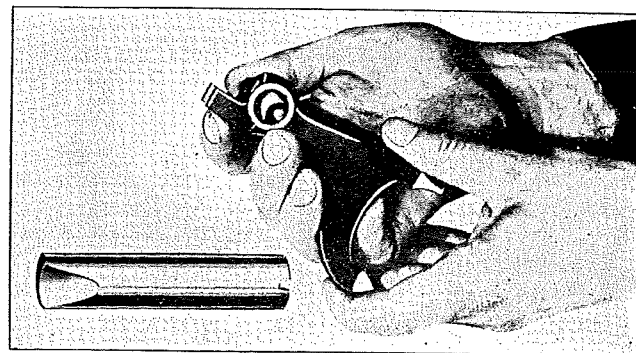


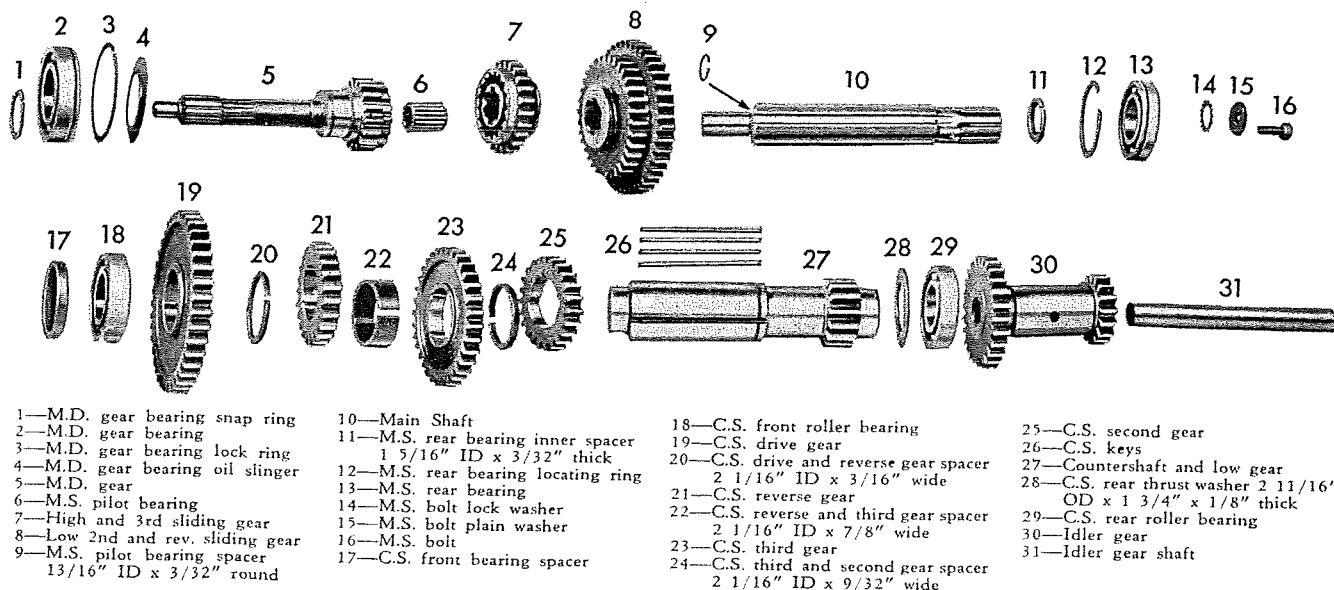
Fig. 93—Group No. 32 Method of assembling shift shafts in forks

end of the shaft should be in a horizontal position on 1935-36 trucks and in a vertical position for 1937-42 units.

(4)—Install the main drive gear assembly in the case and fasten the retainer. (5)—Dip the mainshaft front pilot bearing in gear oil and place it in the pocket of the main drive gear. (6)—Hold the sliding gears in the case with the shift fork channels facing each other and insert the mainshaft through the gears. (7)—Push the shaft all the way into position and replace the universal ball retainer and gasket. (8)—Place the transmission in low and second gears to prevent the mainshaft from turning and install the universal joint, fastening it with the cap screw. (9)—Replace the speedometer driven gear and shaft. (10)—Install the cover.

WITH HOTCHKISS DRIVE

Except for the following instructions, the service procedure is the same as described for torque tube drive trucks.



- 1—M.D. gear bearing snap ring
- 2—M.D. gear bearing
- 3—M.D. gear bearing lock ring
- 4—M.D. gear bearing oil slinger
- 5—M.D. gear
- 6—M.S. pilot bearing
- 7—High and 3rd sliding gear
- 8—Low 2nd and rev. sliding gear
- 9—M.S. pilot bearing spacer
13/16" ID x 3/32" round

- 10—Main Shaft
- 11—M.S. rear bearing inner spacer
1 5/16" ID x 3/32" thick
- 12—M.S. rear bearing locating ring
- 13—M.S. rear bearing
- 14—M.S. bolt lock washer
- 15—M.S. bolt plain washer
- 16—M.S. bolt
- 17—C.S. front bearing spacer

- 18—C.S. front roller bearing
- 19—C.S. drive gear
- 20—C.S. drive and reverse gear spacer
2 1/16" ID x 3/16" wide
- 21—C.S. reverse gear
- 22—C.S. reverse and third gear spacer
2 1/16" ID x 7/8" wide
- 23—C.S. third gear
- 24—C.S. third and second gear spacer
2 1/16" ID x 9/32" wide

- 25—C.S. second gear
- 26—C.S. keys
- 27—Countershaft and low gear
- 28—C.S. rear thrust washer 2 11/16"
OD x 1 3/4" x 1/8" thick
- 29—C.S. rear roller bearing
- 30—Idler gear
- 31—Idler gear shaft

Fig. 94—Group No. 32 Transmission

(1)—Lock the transmission in low and second gears to prevent the mainshaft from turning and take off the nut from the stud in the end of the universal joint flange. (2)—Unbolt the oil seal retainer from the mainshaft rear bearing retainer and use a puller to remove the oil seal, its retainer and speedometer drive gear as a unit.

NOTE—At this point, if repairs are to be made to the transmission, proceed as already described.

If the oil seal is to be replaced, press off the speedometer drive gear, take out the oil seal and replace with the new one after first soaking the seal in light engine oil for about one hour. Install the speedometer drive gear with its chamfered edge facing the front of the transmission.

GROUP No. 33

Figs. 95, 96

G.M.C. 1937-42, $\frac{1}{2}$ TON USING THREE-SPEED SYNCHRO-MESH WITH REMOTE GEARSHIFT CONTROL

The transmission used in these trucks is of the same design and is serviced in the same manner as described for Group No. 32, therefore, only the gearshift control service will be covered.

Assuming that the transmission has not been removed from the chassis, disassemble the cover in the following manner: (1)—Remove the outer nut and spacer and disconnect the selector cable from the yoke. (2)—Disconnect the cable housing from the cover. (3)—Remove the cotter pin, plug, ball seat and spring at the rear end of the control rod and disconnect the shift control rod from the shift shaft outer lever. (4)—Unbolt the cap screws which fasten the cover to the transmission and lift it off. (5)—The selector cable yoke may be removed after releasing the hairpin cotter pin from the yoke stud. (6)—Remove the nut, washer and inner lever from the shift shaft and take out the shaft.

Assemble in the reverse order, being sure to observe the following: (a)—Check the selector plate and shift bar to be sure they are not warped. (b)—The shift bar pins must not bind in the notches of the selector plate. (c)—When assembled, be sure that the selector cable is not twisted.

SELECTOR CABLE, ADJUST: Remove the plate from the transmission case cover and turn the adjusting nuts on each side of the selector cable yoke until the distance between the top of the steering wheel to the center of the shift lever knob is $5\frac{1}{4}$ " with the lever in neutral position. NOTE—Turn the nuts toward the

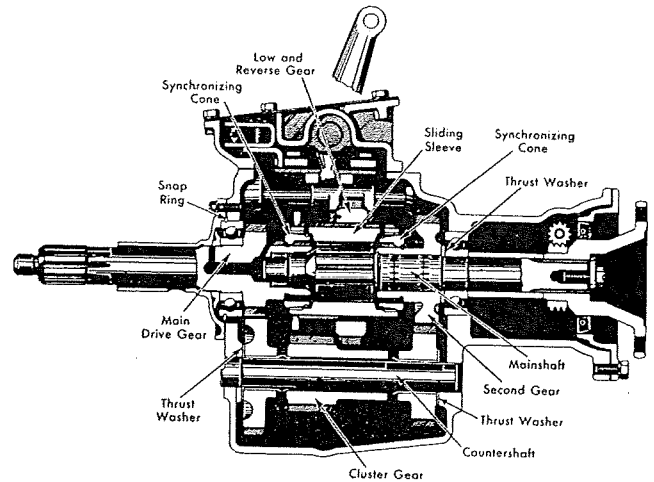
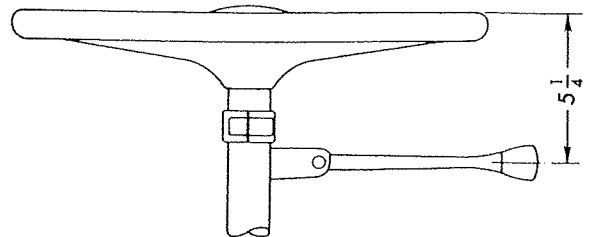


Fig. 95—Group No. 33 Transmission

end of the cable to bring the shift lever nearer to the steering wheel; turning them away from the end of the cable moves the shift lever away from the wheel.

ENGAGEMENT POSITION, ADJUST: Loosen the lock nut on the eccentric ball stud located in the transmission case outer lever. Turn the eccentric ball stud until the end of the shift lever knob is $2\frac{1}{2}$ " ahead of the center line of the steering column.

SHIFT CONTROL ROD ENDS, ADJUST: With all parts assembled, screw the end plugs firmly against their seats and back off from $\frac{1}{8}$ to $\frac{3}{8}$ turn and lock in place with cotter pins.



Showing gearshift lever adjustment

Fig. 96—Group No. 33

LUBRICATION: If the shift control has been removed, Lubriplate should be applied to threads, plugs, plunger and bearings in the upper end of the shift control shaft; the lower end of the rod and bearings in the lower end of the shift shaft, and the anti-rattle spring at the upper end of the shift shaft. CAUTION—Do not lubricate the selector rod rubber sleeve.

GROUP No. 34

Fig. 97

GMC THREE-SPEED AUXILIARY

DISASSEMBLE

(1)—Take off the transmission cover. (2)—Disconnect the hand brake mechanism. (3)—Lock the transmission in two gears to prevent the mainshaft from turning and remove the front and rear universal flanges. (4)—Take off the front and rear countershaft bearing retainers, collecting the shims under the rear retainer. (5)—Disconnect the mainshaft rear bearing retainer and remove the cage and bearing assembly, noting the thickness of shims under the retainer. NOTE—Screw holes are provided for use of a puller when removing the bearing assembly. (6)—Release the snap ring and screw out the front bearing adjusting nut, then remove the cage and bearings. (7)—Tap the countershaft toward the rear until the rear bearing race is free of the case. NOTE—While doing this, move the mainshaft to the rear. (8)—Separate the mainshaft from the main drive gear, leaving the mainshaft front pilot bearing in the pocket of the main drive gear. (9)—Lift the front end of the mainshaft and move the countershaft to the front. (10)—Lift the mainshaft assembly out by passing the teeth of the low speed gear between the teeth of the power take-off gear. (11)—Push the main drive gear into the transmission and lift it out through the top. (12)—Lift the countershaft assembly out of the case.

MAINSHAFT: To disassemble: (a)—Slip the sliding clutches from the shaft. (b)—Release the snap ring at the front end of the shaft. NOTE—It may be necessary to use a puller to remove the splined sleeve from the mainshaft, and when doing so, use a cloth under the assembly to catch the bearing rollers as the gear and sleeve are removed. When pulling the low speed gear, use the same precaution.

To assemble the mainshaft: (a)—Fasten the shaft in a vise with its rear end up. (b)—Grease the inner bearing race and install forty-eight rollers around the shaft. (c)—Assemble the third speed gear on the shaft with its splined hub up. (d)—Install the wide bearing spacer in place and grease the shaft at the gear hub opening. (e)—Assemble forty-eight more rollers between the hub of the gear and the shaft. (f)—Replace the short splined sleeve and thrust collar in position, with the conical end of the collar up. (g)—Press the collar sleeve firmly against the gear. (h)—Fasten the shaft in the vise with its front end up and assemble the overdrive gear and bearings in the same manner, using the long splined sleeve and snap ring to hold the gear in position. (i)—Install the sliding clutches over the sleeves, being sure to have the shifting collars toward each other.

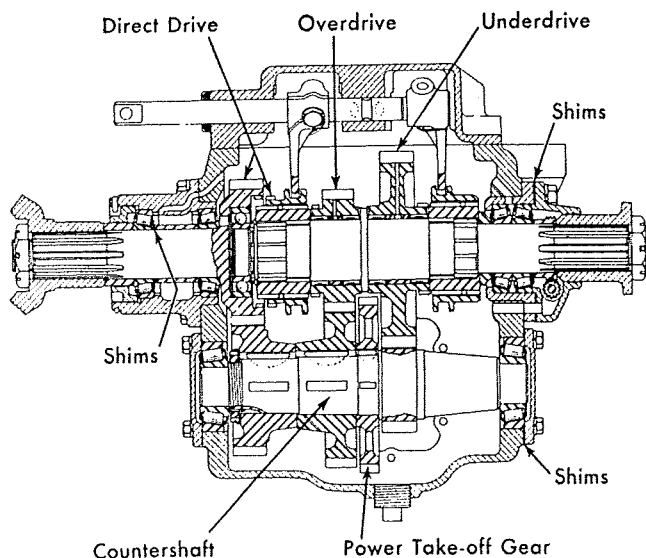


Fig. 97—Group No. 34 Transmission

ASSEMBLE

(1)—Place the countershaft assembly in position but do not replace the bearing races. (2)—Assemble the main drive gear in a press, being sure to use the original quantity of shims as were removed. (3)—Place the short bearing spacer in position and use a suitable piece of pipe or tubing to press the assembly in position. NOTE—When properly adjusted, the bearing cage should turn freely, but should not spin when the pressure is applied to the shaft. Add or remove shims as required to obtain the proper adjustment, and disassemble again, carefully placing this amount of shims aside for installation later. (4)—Install the main drive gear in the case. (5)—Replace the mainshaft assembly through the top and out through the rear of the case. (6)—Pass the mainshaft low gear between the teeth of the power take-off gear. (7)—Move the mainshaft and countershaft toward the rear of the case at the same time until the mainshaft is in a position to enter the front pilot bearing in the main drive gear. (8)—Move the mainshaft and countershaft forward at the same time to their correct positions. (9)—Assemble the main drive gear bearing and cage assembly, using the quantity of shims which were laid aside previously. (10)—Fasten the retainer to the case securely and install the lock ring. (11)—Replace the mainshaft rear bearing cage and gasket, being sure to align the oil return hole in the gasket with the corresponding hole in the case and flange. (12)—Assemble the rear bearings, using a suitable piece of pipe or tubing. (13)—Insert the rear bearing outer race and retainer, using the original quantity of shims as were removed. CAUTION—Make sure the oil holes in the shims align with the oil hole in the flange. With the bearing retainer fastened securely to the case, the end play of the

bearings can be checked. The adjustment is correct when the shaft can be turned freely. If the shaft binds, add or remove shims as required to obtain the proper adjustment. (14)—Assemble the countershaft front bearing retainer and gasket. (15)—Replace the original quantity of shims under the countershaft rear bearing retainer and fasten the retainer securely. (16)—Check the end play and add or remove shims as required to obtain from .000" to .002" end play. (17)—Complete the assembly by installing the universal flanges, brake mechanism and transmission cover.

GROUP No. 35

Fig. 98

DODGE TRUCK, 1937-42, 1/2-3/4 TON DODGE THREE-SPEED SILENT MESH PLYMOUTH TRUCK

DISASSEMBLE

(1)—Remove the transmission cover and shifter assembly. (2)—Unscrew the nut from the end of the mainshaft and use a puller to remove the universal flange and brake drum assembly. (3)—Take out the speedometer driven gear and oil seal. (4)—Disconnect the hand brake mechanism. (5)—Unbolt the cap screws and remove the brake support, oil seal and hand brake assembly. (6)—Remove the speedometer drive gear. (7)—Detach the main drive gear bearing retainer. (8)—Push the mainshaft assembly out through the rear of the case enough to use a suitable puller to remove the rear bearing. (9)—Lift out the mainshaft assembly through the top of the case. (10)—Remove the countershaft lock plate and drive the shaft out through the rear, using a dummy shaft to hold the needle bearings and thrust washers in position. NOTE—Allow the cluster gear to lie in the bottom of the case until the main drive gear is removed. (11)—Push the main drive gear out through the front, and if the bearing is to be removed, unscrew the bearing lock nut. (12)—Lift out the countergear assembly. (13)—Drive the reverse idler shaft out rearward and lift out the gear.

MAINSHAFT: (a)—On 1937-40 trucks, slip off the clutch sleeve and low speed gear. (b)—Remove the second speed thrust washer and lock and slide the gear from the shaft. NOTE—Assemble in the reverse order, installing the clutch sleeve with the side marked "Front" in that position. Check the end play of the second speed gear which should be from .003" to .008". Thrust washers of several thicknesses are available to establish this end play.

For 1941-42 units, before removing the synchronizer assembly, mark the relationship of the synchronizer rings with the clutch sleeve so that installation may be made in the original position. Then remove the rings,

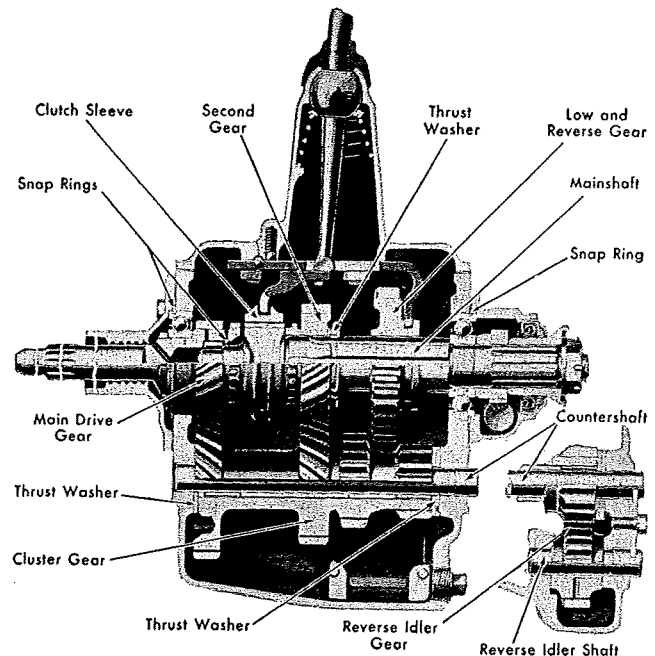


Fig. 98—Group No. 35 Transmission

unhook the spreader springs from the shifting plates and slide the clutch sleeve from the clutch gear. NOTE—When assembling, one of the turned out ends of each spring should be inserted in opposite ends of the same shifting plate. The balance of the mainshaft assembly is the same as described for 1937-40 models.

ASSEMBLE

(1)—Assemble the reverse idler by driving the shaft in through the rear. (2)—Place the countershaft gear assembly in the bottom of the case but do not install the shaft until the main drive gear is in place. (3)—If the mainshaft front pilot bearings have been removed, assemble them in the pocket of the main drive gear and lock them in place with the snap ring, then replace the main drive gear through the front, locking the bearing in place with a new snap ring. (4)—Install the drive gear bearing retainer, using a new gasket. (5)—Install the countergear assembly by driving the dummy shaft out through the front, locking the assembly with the lock plate. NOTE—End play of the countershaft should be from .004" to .015", which can be established by using thrust washers of the required thickness. (6)—Place the mainshaft into the case and out through the rear bearing hole, then install the rear bearing on the shaft. (7)—Push the mainshaft forward to its normal position. (8)—Complete the assembly by assembling the speedometer drive gear, brake support and brake assembly; connect the brake mechanism; install the speedometer driven gear and

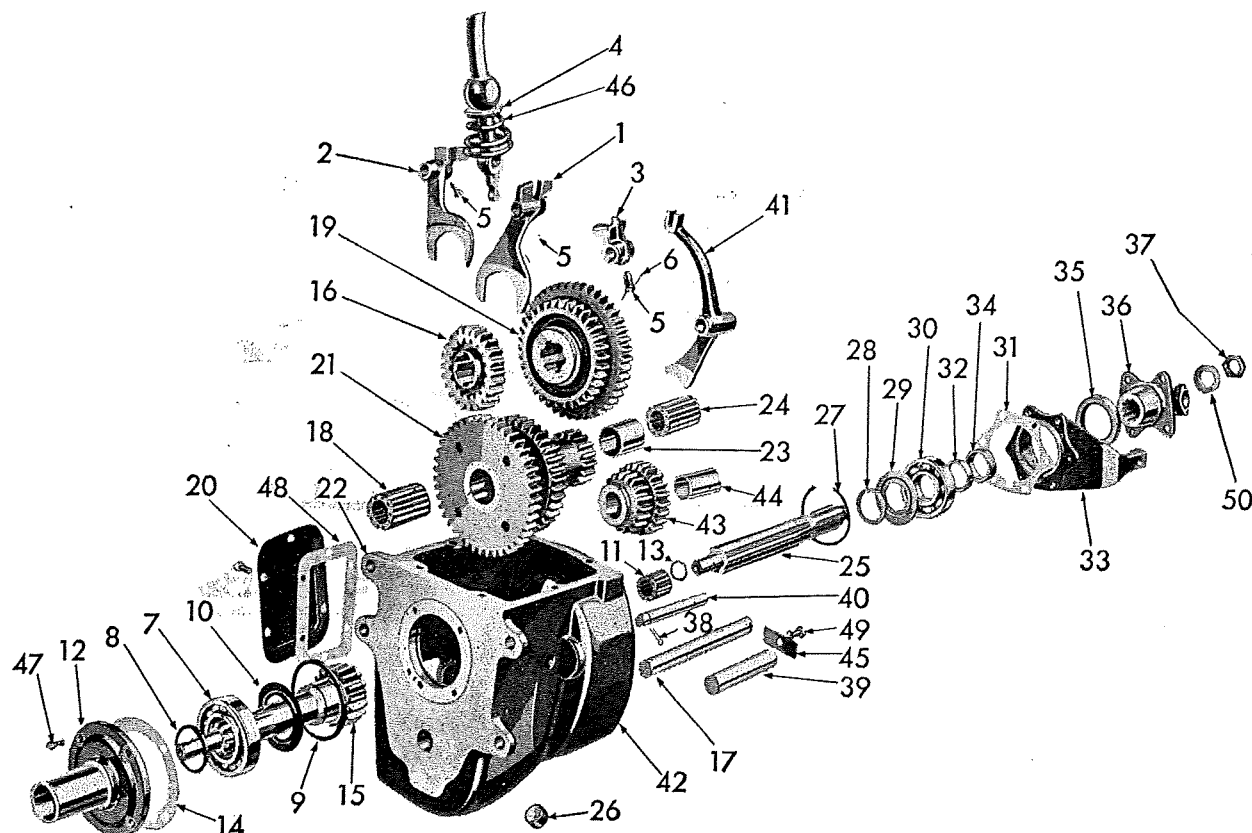


Fig. 99—Group No. 36 Transmission

- | | | |
|---|---|---|
| 1—Gearshift fork—third and direct | 17—Transmission countershaft | 34—Speedometer drive gear |
| 2—Gearshift fork—low and second | 18—Transmission countershaft bearing | 35—Transmission main shaft rear bearing retainer oil seal |
| 3—Gearshift reverse rail end | 19—Transmission main shaft low and second gear | 36—Transmission main shaft yoke (flange) |
| 4—Gearshift lever spring seat | 20—Power take-off cover | 37—Transmission main shaft yoke nut |
| 5—Gearshift fork and end lock screw | 21—Transmission countershaft gears (integral) | 38—Gearshift reverse fork rail cotter |
| 6—Gearshift fork and end lock screw lockwire | 22—Transmission case | 39—Transmission reverse idler shaft |
| 7—Transmission main drive pinion bearing | 23—Transmission countershaft bearing spacer | 40—Gearshift reverse fork rail |
| 8—Transmission main drive pinion snap ring | 24—Transmission countershaft bearing | 41—Gearshift fork—reverse |
| 9—Transmission main drive pinion bearing snap ring | 25—Transmission main shaft | 42—Transmission case |
| 10—Transmission drive pinion bearing oil retainer washer | 26—Transmission case drain plug | 43—Transmission reverse idler gear |
| 11—Transmission main shaft pilot bearing | 27—Transmission main shaft rear bearing snap ring | 44—Transmission reverse idler gear bushing |
| 12—Transmission main drive pinion bearing retainer | 28—Transmission main shaft rear bearing washer | 45—Transmission countershaft and reverse idler shaft lock plate |
| 13—Transmission main shaft pilot bearing spacer | 29—Transmission main shaft rear bearing oil retainer washer | 46—Gearshift lever spring |
| 14—Transmission main drive pinion bearing retainer gasket | 30—Transmission main shaft rear bearing | 47—Main drive pinion bearing retainer screw and lockwasher |
| 15—Transmission main drive pinion | 31—Transmission main shaft rear bearing retainer gasket | 48—Power take-off cover gasket |
| 16—Transmission main shaft third and direct gear | 32—Speedometer drive gear spacer | 49—Shaft lock plate screw and lockwasher |
| | 33—Transmission main shaft rear bearing retainer and hand brake support | 50—Main shaft yoke nut washer |

oil seal, and the brake drum and flange assembly. (9)—Finally, place the clutch sleeve and low speed gear in neutral position and replace the cover.

GROUP No. 36

Figs. 99, 100

WARNER FOUR-SPEED SLIDING GEAR

Models T9, T9A, TR11, TR27

DISASSEMBLE

(1)—Set the gearshift lever in neutral, remove the cover screws and lift off the transmission cover and shifter assembly. (2)—Unscrew the nut from the uni-

versal flange and take off the hand brake band, brake drum and universal flange. (3)—Remove the bell housing and disconnect the main drive gear bearing retainer and remove the gear and bearing through the front. (4)—Remove the speedometer driven gear and take off the mainshaft rear bearing retainer, oil seal and speedometer drive gear. NOTE—Before removing the mainshaft, mark the relationship of the mainshaft splines with the matching splines in the sliding gears so that assembly may be made in the original position, as these gears are a selective fit on the shaft splines. (5)—Grasp the mainshaft gears and withdraw the shaft and rear bearing out through the rear and lift the gears out through the top. (6)—Remove the counter-

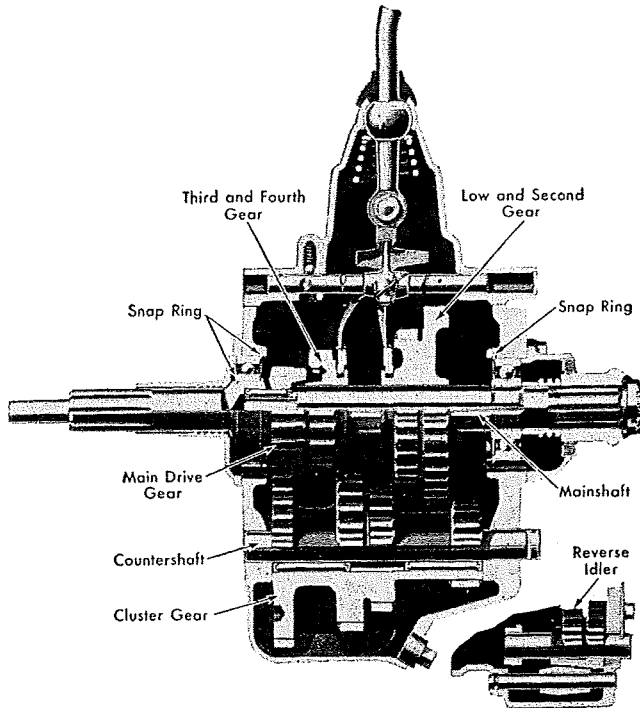


Fig. 100—Group No. 36 Warner T-9

shaft lock plate, tap the shaft out through the rear and lift out the cluster gear. (7)—Pull out the cotter pin from the front end of the reverse shift rail, drive out the rail and lift out the fork. (8)—Tap the reverse idler shaft out rearward and lift out the gear.

SHIFTER MECHANISM: (a)—Press down on the shift lever housing cap and take out the lock pins. NOTE—On some units, the cap is screwed to the housing. (b)—Remove the shift lever ball. (c)—Remove the reverse latch spoon by taking out the bolt and nut located directly under the shift rail. (d)—Remove the reverse latch and slide the springs and washers from the lever. (e)—Unfasten the shift fork lock screws and drive the shift rails out through the rear, forcing out the expansion plugs at the same time. CAUTION—Be sure to collect the poppet balls and springs as the rails are being removed.

NOTE—Assemble in the reverse order, being sure to install new expansion plugs and, after tightening the shift fork lock screws, wire them securely.

ASSEMBLE

(1)—Assemble the reverse idler gear by tapping the shaft in through the rear. (2)—Place the countergear assembly in the case with the bearings and bearing spacer in position, then replace the reverse rail and fork, locking the rail in place with a cotter pin. (3)—Assemble the countershaft through the rear and replace the lock plate and screw. (4)—Install the mainshaft through the rear of the case, slipping on the sliding gears, being sure that the marked splines of the

gears and shaft are meshed. NOTE—The larger gear belongs at the rear and shift fork channels must face each other. (5)—Assemble the speedometer gear and rear bearing retainer. (6)—Install the main drive gear and bearing assembly through the front, using a new snap ring. (7)—Fasten the main drive gear bearing retainer in place, using a new gasket. (8)—Complete the assembly by replacing the universal flange and brake drum, brake band, the transmission cover assembly and the bell housing.

GROUP No. 37

WARNER FIVE-SPEED CONSTANT MESH Model T-93

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (3)—Use a puller if necessary, to remove the flange. (4)—Detach the speedometer driven gear. (5)—Remove the mainshaft rear bearing retainer and the speedometer drive gear. (6)—Force the mainshaft to the rear far enough to permit the removal of the rear bearing. (7)—Release the reverse shift rail lock and pull the rail out through the rear. (8)—Shift the mainshaft to the rear to clear the main drive gear and tilt the front end up and lift the assembly out of the case. (9)—Disconnect the main drive gear bearing retainer and slip it off the shaft. (10)—Release the snap ring from in front of the bearing, push the gear into the case and lift it out through the inside of the case. (11)—Tap the main drive gear bearing out of the case. (12)—Take off the countershaft rear bearing cap. (13)—Take out the two screws which fasten the countershaft rear bearing retainer and remove the retainer washer. (14)—Force the countershaft to the rear far enough to remove the rear bearing. (15)—Tilt the front end of the assembly upward and lift it out of the case. (16)—Remove the snap ring from in front of the countershaft front bearing expansion plug and tap the bearing and plug out of the case. (17)—Release the reverse idler shaft lock plate and pull the shaft out rearward and lift out the gear.

MAINSHAFT: (a)—To disassemble, slip the sliding gears from the shaft. (b)—Release the snap ring from in front of the fourth speed gear (fifth gear on overdrive units) and slide the gears, bearings and thrust washers from the shaft.

To assemble: (a)—Clamp the mainshaft in a vise with its front end up and replace the third speed gear rear thrust washer. (b)—Assemble the third speed gear inner race and third speed gear and insert the rollers between the race and gear, using grease to hold the rollers in place. (c)—Slip the intermediate thrust washer over this assembly and replace the fourth speed gear and bearings in the same manner. NOTE—On overdrive units, before installing the fifth gear and bushing, be sure to lubricate the bushing. (d)—Install

TRANSMISSION, OVERHAUL

the front thrust washer, pressing the assembly down firmly and install a new snap ring to hold the entire assembly in place. (e)—Slip the sliding clutch gear on the shaft. (f)—Lubricate the mainshaft splines and replace the sliding gears with the larger gear to the rear, and with the shift fork channels facing each other.

ASSEMBLE

(1)—Assemble the reverse idler gear and bearing assembly in the case and push the shaft in through the rear, locking the assembly in place with the lock plate and screw. (2)—Install the countershaft front bearing and expansion plug, using a new snap ring to hold it in place. (3)—If the countershaft helical gears require replacement, press them off one at a time, and when installed, be sure the keys are tight and stake them in place with a prick-punch. (4)—Assemble the gears in the case and replace the countershaft rear bearing, locking the assembly in place with the retainer and cap screws, after which, replace the rear bearing cap. (5)—Insert the main drive gear bearing in the case and install the drive gear through the inside of the case, using a new snap ring to hold the assembly in position, then replace the bearing retainer. (6)—Lubricate the mainshaft pilot bearing and install it in the recess of the main drive gear. (7)—Hold the mainshaft and gear assembly in position and replace the rear bearing. (8)—Install the reverse shift rail and lock it with its lock plate. (9)—Install the speedometer drive gear and replace the mainshaft rear bearing retainer. (10)—Replace the universal flange, locking it securely in place by screwing the nut on the end of the mainshaft. (11)—Complete the assembly by replacing the speedometer drive gear and the transmission cover assembly.

SHIFTER MECHANISM: (a)—To disassemble, drive the expansion plugs out of the front end of the cover. (b)—With all the rails in the neutral position, remove the shift fork and lug lock screws and drive the rails out through the front. **CAUTION**—Hold a hand over the lock ball holes to prevent the balls and springs from flying out as the rails are removed; as soon as each rail is taken out, it should be tagged to assure correct assembly. (c)—Drive the expansion plug from the side of the cover and tip the cover up on edge to allow the interlock plungers to drop out. (d)—Disassemble the reverse shifter lug plunger.

NOTE—Assemble the cover in the reverse order, lubricating all poppet balls and springs before replacing. Be sure to insert the interlock plungers correctly in the center rail. See that the points of all lock screws engage the holes in the shift rails before wiring the screws in place. Check the reverse shifter lug plunger

for freedom of operation, and when assembled, turn the adjusting nut so that the plunger is flush with the face of the slot to line up with the end of the shift lever.

GROUP No. 38

Fig. 101

CLARK FIVE-SPEED CONSTANT MESH MODELS 200V, 200VO, 205V, 205VO

NOTE—Some of these transmissions use underdrive fourth speed with direct drive in fifth while other units employ fourth speed as direct with overdrive in fifth. Fourth speed gear in the underdrive transmission is mounted on roller bearings, the inner race of which is drilled for a pin which engages a spline on the mainshaft to prevent the race from turning. Fifth speed gear on the overdrive transmission uses the same inner race but with a bronze bushing instead of roller bearings.

DISASSEMBLE

(1)—Take off the transmission cover and shift lever assembly. (2)—Remove the speedometer driven gear. (3)—Disconnect the hand brake lever mechanism and remove the hand brake band. (4)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the nut which fastens the universal flange to the mainshaft. (5)—Use a puller if necessary, to remove the universal flange and brake drum. (6)—Unfasten the main drive gear bearing retainer and withdraw the gear assembly out through the front. (7)—Slip the sliding clutch gear from the mainshaft. (8)—Disconnect the mainshaft rear bearing retainer and push the mainshaft far enough to the rear to permit the removal of the rear bearing and speedometer drive gear. (9)—Tilt the front end of the mainshaft upward and lift the assembly out through the top. (10)—Remove the countershaft rear bearing retainer cap and unscrew the two bearing retainer bolts. (11)—Push the countershaft far enough to the rear to permit the removal of the rear bearing. (12)—Tilt the forward end of the countershaft assembly upward and lift it out of the case. (13)—Release the front bearing snap ring and tap the countershaft front bearing and retainer out through the front of the case. (14)—Remove the lock and tap the reverse idler shaft out through the rear and lift out the gear and bearings.

MAINSHAFT: To disassemble, slip the sliding gears off the shaft. Align the splines of the front thrust

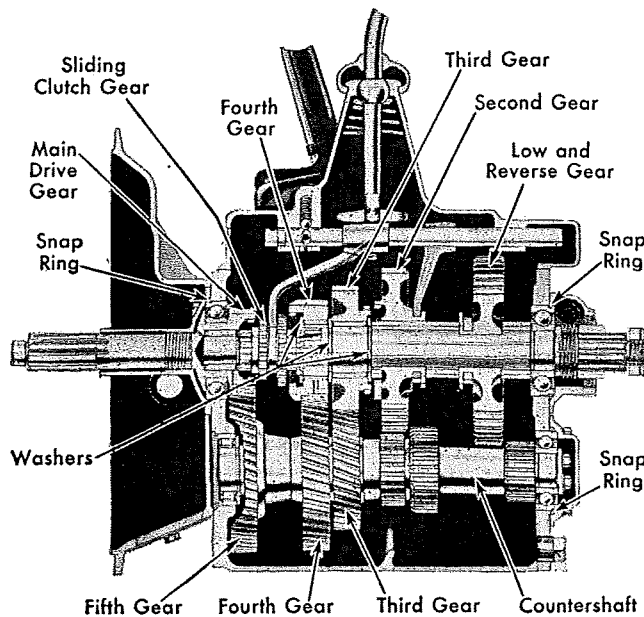


Fig. 101—Group No. 38 Clark 205V

washer with the mainshaft splines and slide the gears, bearings and thrust washers from the front end of the shaft.

To assemble: (a)—Clamp the mainshaft in a vise with its front end facing upward and install the third speed gear rear thrust washer. (b)—Place the third speed gear on the shaft and insert the roller bearings, using grease to hold them in position. (c)—Install the intermediate thrust washer and the fourth speed gear inner race (fifth speed inner race on overdrive units), engaging the pin with a mainshaft spline. NOTE—On underdrive units, install the fourth speed gear and roller bearings in the same manner as the third speed gear. On overdrive units, before installing the fifth speed gear and bushing, make sure all the oil holes are clear and the bushing lubricated. (d)—Place the front thrust washer in position and install a new snap ring. (e)—Lubricate the mainshaft splines and slip the sliding gears on the shaft, with the larger gear at the rear. NOTE—The shift fork channels must face each other. (f)—Install the sliding clutch gear on the front end of the mainshaft.

ASSEMBLE

REVERSE IDLER: (1)—Assemble the bearing spacer and bearings in the gear and place the assembly in the case with the smaller gear toward the rear. (2)—Tap the idler shaft in through the rear and engage the slot in the locking plate and bolt it securely.

COUNTERSHAFT: NOTE—With the exception of the low and reverse gear, the gears may be replaced, and when installed, be sure the four keys are a tight fit and stake them in place with a prick-punch. (3)—As-

semble the countershaft front bearing and its retainer and lock it with a new snap ring. (4)—Place the countershaft assembly in position and install the rear bearing, fastening it securely with the two retaining cap screws. (5)—Replace the bearing retainer cap and gasket.

MAINSHAFT: (6)—Assemble the mainshaft and gears in position and install the rear bearing. (7)—Replace the speedometer drive gear and rear bearing retainer.

MAIN DRIVE GEAR: (8)—Lubricate the mainshaft front pilot bearing and place it in the pocket of the main drive gear. (9)—Install the main drive gear through the front and replace the retainer, fastening it securely to the case.

NOTE—Complete the assembly by replacing the universal flange and brake drum, fastening the nut securely to the end of the mainshaft. Install the hand brake band and connect the linkage, after replacing the cover.

SHIFTER MECHANISM: (a)—To disassemble, drive the expansion plugs out of the front end of the cover. (b)—With all the rails in the neutral position, remove the shift fork and lug lock screws and drive the rails out toward the front. CAUTION—Hold a hand over the lock ball holes to prevent the balls and springs from flying out as the rails are removed. As soon as each rail is taken out, it should be tagged so that assembly may be made correctly. (c)—drive the expansion plug from the side of the cover and tip the cover up on edge to allow the interlock plunger balls, springs and pin to drop out. (d)—Disassemble the reverse shifter lug plunger.

NOTE—Assemble the cover in the reverse order, lubricating all balls and springs before replacing. Be sure to insert the interlock balls, springs and interlock pin correctly in the center rail. See that the points of all lock screws engage the holes in the rails before wiring the screws in place. To prevent the loss of lubricant, always install new expansion plugs. Check the reverse shifter lug plunger for freedom of operation, and when assembled, turn the adjusting nut so that the plunger is flush with the face of the slot to line up with the end of the shift lever.

GROUP No. 39

Fig. 102

CLARK FOUR-SPEED CONSTANT MESH

Model 185F

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Remove the speedometer driven gear. (3)—Disconnect the hand brake mechanism and remove the hand brake band. (4)—Engage the second

TRANSMISSION, OVERHAUL

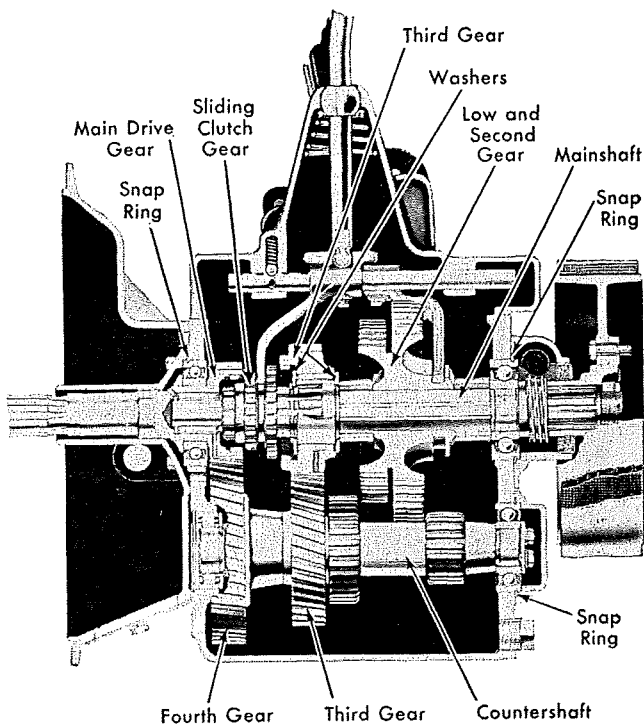


Fig. 102—Group No. 39 Clark 185F

and low speed gears to prevent the mainshaft from turning and unscrew the nut from the rear end of the mainshaft. (5)—Use a puller if necessary, to remove the universal flange. (6)—Disconnect the mainshaft rear bearing retainer. (7)—Remove the bell housing and main drive gear bearing retainer. (8)—Withdraw the main drive gear assembly through the front of the case. (9)—Slip the sliding clutch gear from the front of the mainshaft and push the mainshaft to the rear far enough to permit the speedometer drive gear and rear bearing to be removed. (10)—Tilt the front end of the mainshaft upward and lift the assembly out through the top. (11)—Remove the countershaft rear bearing retainer cap, the retaining bolts and washer. (12)—Push the countershaft far enough to the rear to permit the rear bearing to be removed. (13)—Tilt the front end of the countershaft upward and lift the assembly out of the case. NOTE—The fourth and third speed gears can be replaced by pressing them from the shaft after releasing the snap ring, and when installed, be sure that the keys are a tight fit and staked in place with a prick-punch. (14)—Remove the reverse idler shaft lock, tap the shaft out through the rear and lift out the gear.

MAINSHAFT: To disassemble, slide the first and second sliding gear from the shaft. Release the snap ring from the front of the third speed gear, rotate the thrust washer until its teeth register with the mainshaft splines and remove the washer. The third speed gear, together with the bearings and rear thrust washer may then be removed.

SHIFTER MECHANISM: (a)—If necessary to disassemble, drive out the expansion plugs at the front of the cover. (b)—With shift rails in neutral position, remove the set screws from the shift forks and push the rails out toward the front, holding a hand over the lock ball holes to prevent them from flying out. CAUTION—Be sure to tag the rails as they are removed to assure correct assembly. (c)—Drive the expansion plug from the side of the cover and turn the cover up on edge to allow the interlock plungers to drop out. Disassemble the reverse shifter fork assembly. NOTE—Assemble the cover in the reverse order, being sure to lubricate all balls, springs and interlock plungers.

ASSEMBLE

(1)—Insert the reverse idler with the larger gear toward the rear and tap the shaft in through the rear. (2)—Assemble the countershaft front bearing, its retainer and snap ring. (3)—Place the countergear assembly in the case and install the rear bearing, the two retaining cap screws and washer and the retainer cap. (4)—Assemble the mainshaft in the reverse order of removal, using cup grease to hold the roller bearings in the third speed gear; be sure that the third speed gear inner race locating pin engages a spline on the mainshaft. (5)—Lubricate the mainshaft splines and slip the sliding gear on the shaft with the larger gear to the rear. (6)—Assemble the mainshaft and gears in the case and replace the rear bearing, speedometer drive gear and rear bearing retainer. (7)—Lubricate the mainshaft pilot bearing, place it in position in the main drive gear and install the drive gear assembly through the front. (8)—Fasten the drive gear bearing retainer securely in position and replace the bell housing. (9)—Complete the assembly by installing the universal flange, brake drum, hand brake band, transmission cover assembly and speedometer driven gear.

GROUP No. 40

Fig. 103

CLARK FOUR-SPEED CONSTANT MESH Models 230F, 231F

DISASSEMBLE

(1)—Shift the transmission into second speed and take off the cover and shifter assembly. (2)—Remove the speedometer driven gear. (3)—Disconnect the hand brake band and linkage from the transmission. (4)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the nut from the rear of the mainshaft. (5)—Pull off the universal flange and brake drum. (6)—Remove the bell housing and the main drive gear bearing retainer, then pull the gear assembly out through the front. (7)—Slip the sliding clutch gear off the mainshaft and withdraw it through the front. (8)—Disconnect the mainshaft rear

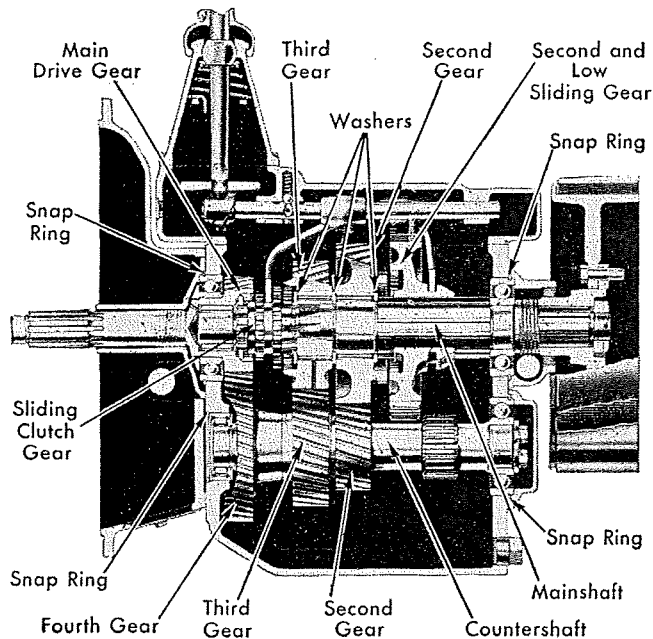


Fig. 103—Group No. 40 Clark 230F

bearing retainer and push the shaft to the rear far enough to permit the removal of the rear bearing and speedometer drive gear. (9)—Tilt the front end of the mainshaft upward and lift the assembly out through the top. (10)—Take off the countershaft rear bearing cap and remove the two screws and washer from the rear bearing. (11)—Push the countershaft far enough to the rear to permit the rear bearing to be removed. (12)—Tilt the front end of the countershaft upward and lift the assembly out of the transmission case. (13)—Remove the lock, tap the reverse idler shaft out rearward and lift out the gear.

MAINSHAFT: (a)—To disassemble, slip the sliding gear from the shaft. (b)—Remove the snap ring from in front of the third speed gear. (c)—Rotate the front thrust washer until its teeth align with the mainshaft splines and take off the gears, together with the roller bearings, inner race, and washers.

To assemble: (a)—Clamp the shaft in a vise with the front end up and slip on the second speed gear rear thrust washer. (b)—Assemble the second speed gear over the shaft and insert the rollers between the gear and the shaft, using grease to hold them in place. (c)—Install the third speed gear rear thrust washer and the inner race, with the locating pin engaging mainshaft spline. (d)—Assemble the third speed gear over the race and insert the rollers, using grease to hold them in place. (e)—Slip on the front thrust washer and hold it down in order to install the snap ring. (f)—Lubricate the mainshaft splines and slip the sliding gear on the shaft with its internal teeth facing the front. (g)—Assemble the sliding clutch gear on the front of the shaft with the larger gear to the rear.

SHIFTER MECHANISM: (a)—If necessary to disassemble, drive the expansion plugs out of the cover. (b)—With all rails in the neutral position, remove the set screws from the shift forks and push the rails out toward the front, holding a hand over the lock ball holes to prevent them from flying out. **CAUTION—**As each rail is removed, tag it to be sure that assembly is made correctly. (c)—Remove the expansion plug from the side of the cover and tilt the cover on its side to allow the interlock plungers to drop out. (d)—Disassemble the reverse shifter fork assembly. **NOTE—**Assemble in the reverse order after lubricating all balls, springs and interlock plungers. When assembling the reverse shifter lug plunger, be sure it works freely and turn the adjusting nut until the plunger is flush with the face of the slot for the end of the shift lever.

ASSEMBLE

(1)—Insert the reverse idler with the larger gear toward the rear and tap in the shaft. (2)—Assemble the countershaft front bearing, its retainer and snap ring. (3)—Place the countershaft assembly in the case and install the rear bearing, the two retaining screws, washer and the retainer cap. (4)—Position the mainshaft assembly in the case and replace the rear bearing, speedometer drive gear and rear bearing retainer. (5)—Lubricate the mainshaft pilot bearing, place it in position in the main drive gear and install the drive gear assembly through the front. (6)—Fasten the drive gear bearing retainer securely in position and replace the bell housing. (7)—Complete the assembly by replacing the universal flange, brake drum, hand brake mechanism, transmission cover and speedometer driven gear.

GROUP No. 41

Fig. 104

CLARK FOUR-SPEED SLIDING GEAR

Model 170FS

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Engage the low and second speed gears to prevent the mainshaft from turning and remove universal flange nut and flange. (3)—Remove the bell housing, the mainshaft rear bearing retainer and main drive gear bearing retainer. (4)—Pull the drive gear assembly out through the front. (5)—Push the mainshaft far enough to the rear to permit the removal of the speedometer drive gear and rear bearing. (6)—Remove the pilot bearing from the end of the mainshaft and lift the mainshaft and gears out through the top. (7)—Disconnect the plate which locks the countershaft and idler shaft and tap both shafts out toward the rear. (10)—Lift out the gears.

SHIFTER MECHANISM: (a)—To disassemble, drive out the expansion plugs from the rear of the cover. (b)—Place the rails in neutral and take out the shift fork lock screws. (c)—Drive out the rails through

TRANSMISSION, OVERHAUL

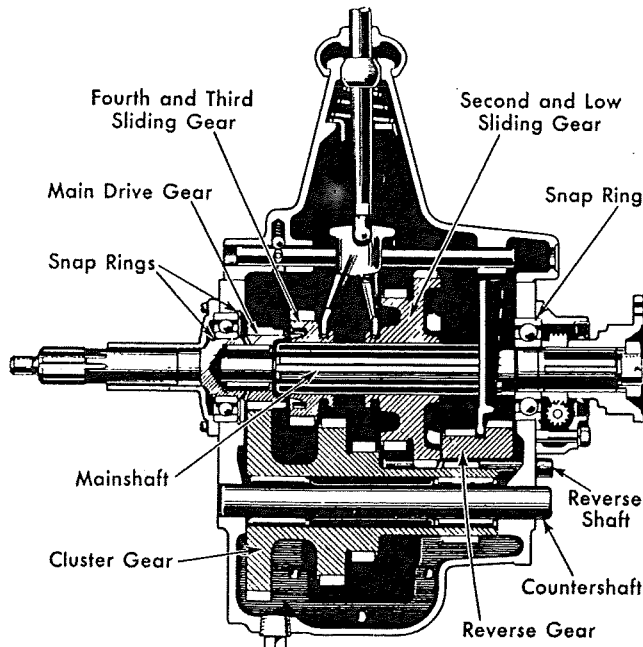


Fig. 104—Group No. 41 Clark 170FS

the front and hold a hand over the lock ball holes to prevent the balls from flying out. CAUTION—Be sure to tag the rails as they are removed to assure correct assembly. (d)—Remove the expansion plug from the side of the cover, tip the cover up on edge to allow the interlock plungers to drop out. (e)—Disassemble the reverse shifter fork plunger. NOTE—Assemble in the reverse order after lubricating all balls, springs and interlock plungers.

ASSEMBLE

(1)—Install the spacer and roller bearings in the countergear and place the assembly in the case. (2)—Insert the countershaft with the slot at the rear facing the idler gear shaft. (3)—Replace the reverse idler gear and shaft, locking both the idler and countershafts with the lock plate. (4)—Place the mainshaft and gear assembly in the case and install the rear bearing and speedometer drive gear, being sure that the rear bearing snap ring is firmly seated in the groove. (5)—Replace the main drive gear and bearing through the front, after lubricating the mainshaft front pilot bearing. (6)—Install the front and rear bearing retainers. (7)—Complete the assembly by assembling the universal flange, speedometer drive gear, transmission cover and bell housing.

GROUP No. 42

Fig. 105

CLARK THREE-SPEED SILENT MESH

Model 140T

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the transmission in two gears

to prevent the mainshaft from turning and unscrew the nut from the universal flange. (3)—Use a puller to remove the flange. (4)—Remove the speedometer driven gear and take off the mainshaft rear bearing retainer. (5)—Remove the bell housing and main drive gear bearing retainer. (6)—Pull the main drive gear out through the front and slip the sliding clutch gear from the front end of the shaft. (7)—Push the mainshaft to the rear far enough to permit the rear bearing and speedometer drive gear to be removed. (8)—Lift the mainshaft and gears out through the top. (9)—Drive the reverse idler shaft and countershaft out rearward and lift out the gears.

SHIFTER MECHANISM: To disassemble, place the rails in the neutral position and drive the pin from the rear end of the rail and slide the rail out of the cover to the rear. CAUTION—Hold a hand over the lock ball holes to prevent the balls and springs from flying out.

ASSEMBLE

(1)—Install the idler gear and countershaft gear by driving the shafts in through the rear. (2)—Assemble the mainshaft in the case and install the rear

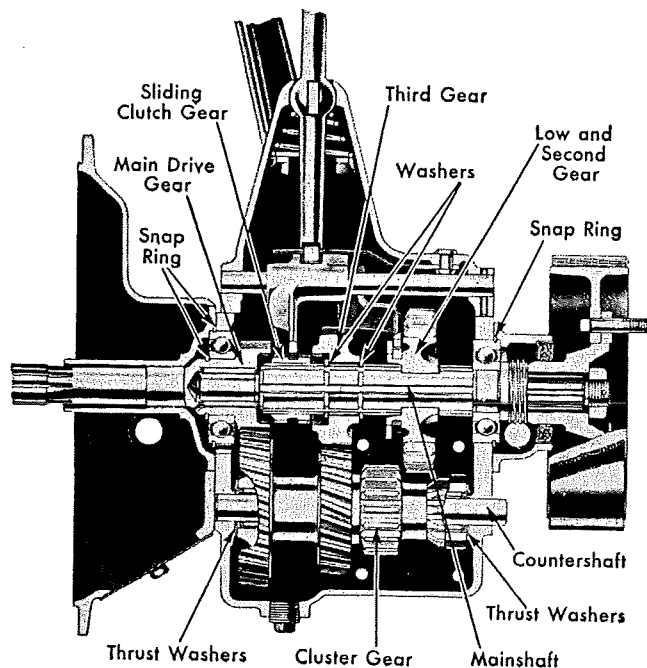


Fig. 105—Group No. 42 Clark 140T

bearing and speedometer drive gear, using a new snap ring in the groove of the rear bearing. (3)—Lubricate the mainshaft pilot bearing and install the main drive gear through the front. (4)—Replace the drive gear

bearing retainer and bell housing. (5)—Install the mainshaft rear bearing retainer, replacing the oil seal if necessary. (6)—Complete the assembly by installing the universal flange, speedometer driven gear and transmission cover assembly.

GROUP No. 43

Fig. 106

CLARK FIVE-SPEED CONSTANT MESH

Models 270V, 270VO, 326V, 326VO

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (3)—Use a puller if necessary to remove the flange. (4)—Remove the bell housing and main drive gear bearing retainer. (5)—Withdraw the drive gear assembly out through the front. (6)—Slip the sliding clutch gear and mainshaft front pilot bearing from the shaft and out through the front of the case. (7)—Remove the speedometer driven gear and rear bearing retainer. (8)—Push the mainshaft far enough to the rear to permit the speedometer drive gear and rear bearing to be pulled off the shaft. (9)—Tilt the front end of the shaft upward and lift it out through the top. (10)—Take off the countershaft rear bearing retainer cap and unscrew the nut from the end of the shaft. (11)—Push the countershaft far enough to the rear to permit the rear bearing to be removed. (12)—Remove the lock and withdraw the reverse idler shaft through the rear. NOTE—If the countershaft front bearing is to be removed, release the snap ring from the groove and push the bearing and expansion plug out through the front.

MAINSHAFT: (a)—To disassemble, slip the sliding gears from the shaft. (b)—Remove the snap ring from in front of the fourth speed gear (fifth gear on overdrive units). (c)—Rotate the front thrust washer until its teeth align with the mainshaft splines and slide the gears, bearings and thrust washers from the shaft.

To assemble: (a)—Clamp the mainshaft in a vise with its front end facing upward and install the third speed gear rear thrust washer. (b)—Place the third speed gear on the shaft and insert the roller bearings, using grease to hold them in position. (c)—Install the intermediate thrust washer and the fourth speed gear inner race (fifth gear inner race on overdrive units), engaging the pin with the mainshaft spline. NOTE—On underdrive units, install the fourth speed gear and roller bearings in the same manner as the third speed gear, using grease to hold the rollers in place. On

overdrive units, before installing the fifth speed gear and bushing, make sure the oil holes are clear and the bushing lubricated. (d)—Place the front thrust washer in position and lock the assembly in place with a new snap ring. (e)—Lubricate the mainshaft splines and slip the sliding gears on the shaft, with the larger gear to the rear. NOTE—The shift fork channels of the sliding gears must face each other. (f)—Install the sliding clutch gear on the front of the shaft.

ASSEMBLE

REVERSE IDLER: (1)—Assemble the bearing spacer and bearings in the gear and place the assembly in the case with the smaller gear toward the rear. (2)—Push the reverse idler shaft in through the rear and engage the slot in the locking plate and bolt it in securely.

COUNTERSHAFT: NOTE—The countershaft gears, including the power take-off gear, but not the low speed gear can be replaced by pressing them from the shaft, and when installed, be sure that the five keys are a tight fit and stake them in place with a prick-punch. (3)—Assemble the front countershaft bearing in the case, install the expansion plug and use a new snap ring to lock it in place. (4)—Place the countershaft assembly in position and install the rear bearing, fastening it securely with the lock nut. (5)—Replace the rear bearing retainer cap and gasket.

MAINSHAFT: (6)—Assemble the mainshaft and gears in position and install the rear bearing, using a

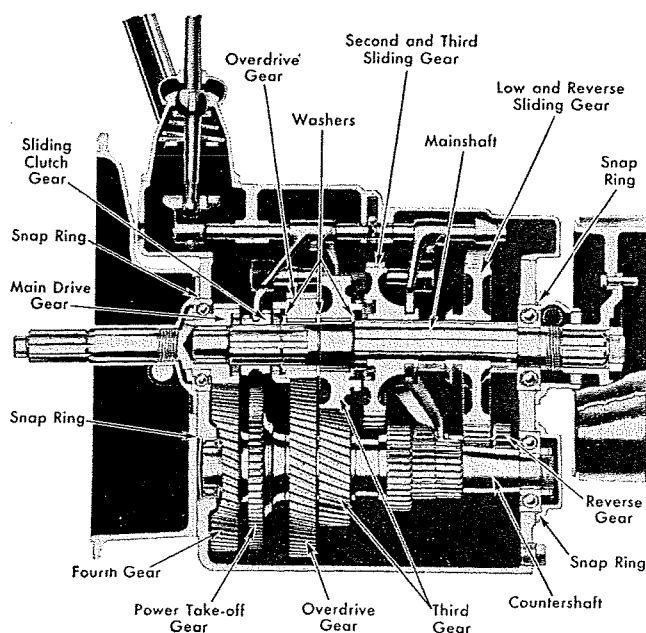


Fig. 106—Group No. 43 Clark 270VO

TRANSMISSION, OVERHAUL

new snap ring. (7)—Replace the speedometer drive gear and rear bearing retainer cap.

MAIN DRIVE GEAR: (8)—Lubricate the mainshaft pilot bearing and place it in the pocket of the main drive gear. (9)—Install the drive gear assembly through the front, using a new snap ring to lock the bearing in place, then fasten the front bearing retainer cap securely to the case.

NOTE—Complete the assembly by replacing the universal flange, fastening the retaining nut securely to the end of the mainshaft. Install the bell housing, speedometer driven gear and transmission cover assembly.

SHIFTER MECHANISM: (a)—To disassemble, drive the expansion plugs out of the front end of the cover. (b)—With all the rails in the neutral position, remove the shift fork and lug lock screws and drive the rails out toward the front. **CAUTION**—Hold a hand over the lock ball holes to prevent the balls and springs from flying out as the rails are removed. As soon as each rail is taken out, it should be tagged so that assembly may be made correctly. (c)—Drive the expansion plug from the side of the cover and tip the cover up on edge to allow the interlock plunger balls, springs and pin to drop out. (d)—Disassemble the reverse shifter lug plunger.

NOTE—Assemble the cover in the reverse order, lubricating all balls and springs before replacing. Be sure to replace the interlock balls, springs and pin correctly in the center rail. See that the points of all

lock screws engage the holes in the rails before wiring the screw in place. To prevent the loss of lubricant, always install new expansion plugs. Check the reverse shifter lug plunger for freedom of operation, and when assembled, turn the adjusting nut so that the plunger is flush with the face of the slot to line up with the end of the shift lever.

GROUP No. 44

Fig. 107

INTERNATIONAL THREE-SPEED SYNCHRO-MESH

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (3)—Use a puller if necessary, to remove the flange. (4)—Remove the speedometer driven gear and front and rear bearing retainers. (5)—Drive the countershaft out rearward. (6)—Pull out the main drive gear assembly from the front. (7)—Remove the mainshaft front pilot bearing and push the mainshaft far enough to the rear to permit the speedometer drive gear and rear bearing to be pulled off the shaft. (8)—Lift the mainshaft and gears out through the top. (9)—Take out the cluster gear assembly. (10)—Drive the reverse idler shaft out through the rear and lift out the gear.

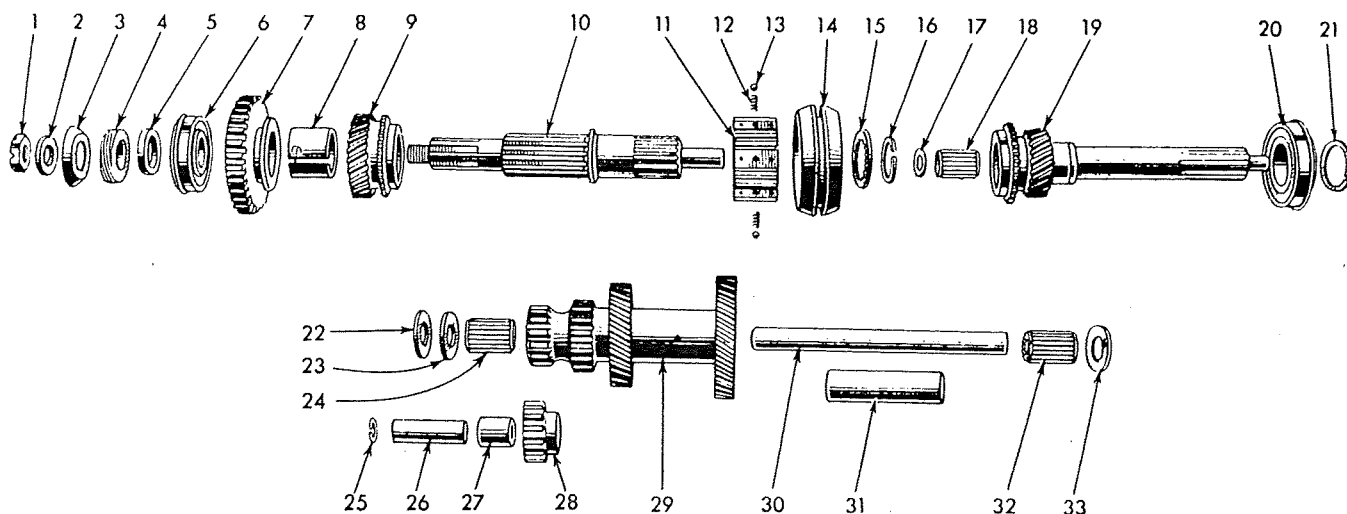


Fig. 107—Group No. 44 Transmission

- 1—Mainshaft nut
- 2—Washer
- 3—Oil slinger
- 4—Speedometer drive gear
- 5—Spacer
- 6—Bearing
- 7—Low and reverse gear
- 8—Second gear bushing

- 9—Second gear
- 10—Mainshaft
- 11—Synchronizer clutch gear
- 12—Clutch gear spring
- 13—Clutch gear ball
- 14—Synchronizer clutch sleeve
- 15—Second gear thrust washer
- 16—Second gear snap ring

- 17—Spacer
- 18—Pilot bearing
- 19—Main drive gear
- 20—Bearing
- 21—Snap ring
- 22—Bronze thrust washer
- 23—Steel thrust plate
- 24—Bearing

- 25—Snap ring
- 26—Reverse idler shaft
- 27—Bushing
- 28—Reverse idler gear
- 29—Cluster gear
- 30—Countershaft
- 31—Bearing spacer
- 32—Bearing
- 33—Bronze thrust washer

MAINSHAFT: (a)—To disassemble, slide the low speed gear from the shaft. (b)—Slip the synchronizer assembly from the shaft, being careful not to allow it to come apart. (c)—Release the snap ring and take the second speed gear, bushing and thrust washer from the shaft. (d)—Assemble in the reverse order.

SYNCHRONIZER: Before disassembling the unit, mark the relationship of the clutch gear with the sleeve so that assembly may be made in the original position. Wrap a cloth around the assembly to avoid losing the balls and springs and push the gear out of the sleeve.

Assemble in the reverse order and use a piston ring compressor-type clamp to assemble gear and ball assembly in the sleeve.

SHIFTER MECHANISM: Remove the lock screws and drive the rails out of the cover. **CAUTION**—Hold a hand over the lock ball holes to prevent the balls and springs from flying out as the rails are removed. Tag the rails as they are removed to assure correct assembly.

NOTE—Assemble the cover in the reverse order, being sure to lubricate the balls and springs before replacing and make certain that the two interlock plungers and spacer are installed correctly between the rails.

ASSEMBLE

(1)—Assemble the reverse idler gear by pushing the shaft in through the rear. (2)—Place the counter-gear assembly in the bottom of the case and use grease to hold the thrust washers in position. (3)—Assemble the mainshaft and gears in the case and install the rear bearing, using a new snap ring to hold the bearing in position. (4)—Lubricate the mainshaft front pilot bearing and place it over the end of the mainshaft, first being sure to install the spacer. (5)—Assemble the main drive gear through the front, using

a new snap ring to hold the bearing in place. (6)—Align the countergear assembly and drive the shaft in through the rear. (7)—Replace the mainshaft rear bearing retainer and lock the countershaft by rotating the retainer until it fits in the countershaft slot. (8)—Replace the speedometer drive gear spacer, the drive gear and oil slinger to the end of the mainshaft and install the universal flange, fastening the assembly securely with the lock nut. (9)—Install the transmission cover assembly.

GROUP No. 45

Fig. 108

INTERNATIONAL AUXILIARY TRANSMISSION

DISASSEMBLE

(1)—Take off the cover plate. (2)—Remove the shift fork lock screw and the grease retainer from the front end of the rail. (3)—Pull the rail out through the front, holding a hand over the lock ball hole to prevent the poppet ball and spring from flying out. (4)—Disconnect both mainshaft and both countershaft bearing retainers. (5)—Pull the main drive gear out through the front. (6)—Slip the sliding clutch gear from the front of the shaft, withdraw the mainshaft through the front and lift the underdrive gear out through the top. (7)—Unscrew the nuts from the front and rear end of the countershaft. (8)—Push the shaft to the rear far enough to permit the rear bearing and spacer to be removed. (9)—Pull the assembly back to free it from the front bearing then lift the shaft and gears out through the top. (10)—If required, remove the bearings and oil seals from the mainshaft retainers. (11)—Assemble in the reverse order, using new gasket and oil seals if necessary.

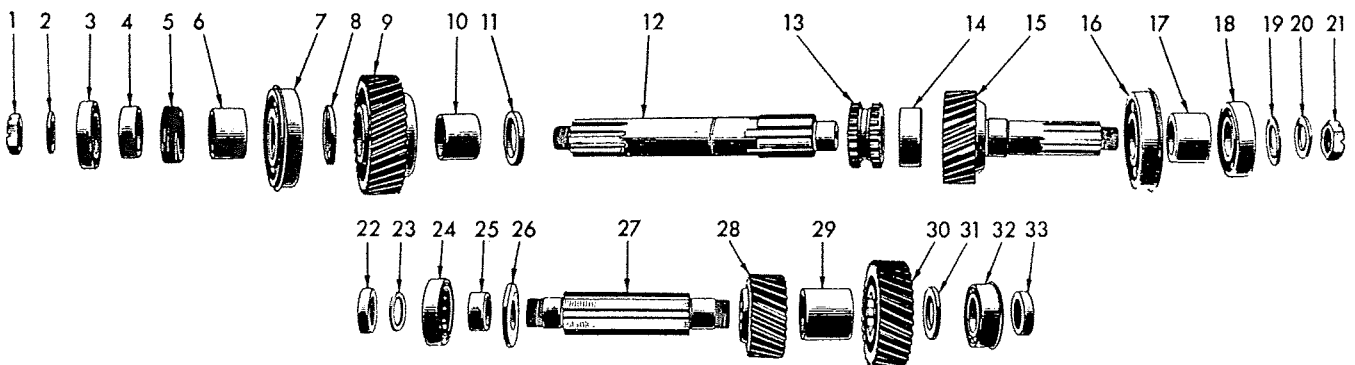


Fig. 108—Group No. 45 Auxiliary Transmission

1—Mainshaft nut
2—Washer
3—Bearing
4—Spacer
5—Speedometer drive gear
6—Spacer
7—Bearing
8—Spacer

9—Underdrive gear
10—Sleeve
11—Spacer
12—Mainshaft
13—Sliding clutch gear
14—Bearing
15—Main drive gear
16—Bearing

17—Spacer
18—Bearing
19—Washer
20—Washer
21—Nut
22—Nut
23—Washer
24—Bearing

25—Bearing
26—Spacer
27—Countershaft
28—Underdrive gear
29—Spacer
30—Drive gear
31—Spacer
32—Bearing
33—Nut

TRANSMISSION, OVERHAUL

GROUP No. 46

Fig. 109

FULLER FIVE-SPEED CONSTANT MESH

Models 5-A-29, 5-A-290, 5-A-33, 5-A-330, 5-A-38,
5-A-380, 5-A-43, 5-A-430, 5-A-62, 5-A-620

DISASSEMBLE

NOTE—Models without the suffix "O" are transmissions with direct drive in fifth, while those with the "O" suffix are overdrive units—direct drive in fourth speed.

(1)—Remove the hand brake lever. (2)—Shift the transmission into first speed and lift off the transmission cover and shifter assembly. (3)—Remove the universal flange nut and pull off the flange. (4)—Take off the mainshaft and countershaft rear bearing retainer caps. (5)—Unscrew the lock nut from the rear end of the countershaft. (6)—Push both the mainshaft and countershaft assemblies to the rear at the same time until the mainshaft rear bearing is clear of the case, then pull off the bearing. (7)—Tilt the front end of the mainshaft upward, grasp the sliding gears and pull the mainshaft with the stationary gears out through the top, after which, lift out the sliding gears. (8)—Remove the clutch release mechanism and take off the main drive gear bearing retainer. (9)—Withdraw the drive gear assembly out through the front. NOTE—On 5-A-620L model, since the gear is larger than the bore in the transmission case, it will be necessary first to remove the bearing lock nut and remove the gear from the inside of the case. (10)—On models equipped with two reverse speeds, take out the high speed reverse shift rail and yoke. (11)—On all units, withdraw the reverse gear shaft (or shafts) and remove the reverse gear (or gears) from the case. (12)—Push the countershaft to the rear far enough to permit the rear bearing to be removed and tilt the front end of the assembly upward and lift it out. (13)—The front bearing may be removed after removing its retainer.

MAINSHAFT: (a)—To disassemble, remove the mainshaft pilot bearing and sliding clutch gear from the mainshaft. (b)—Remove the locking key (or snap ring) which retains the splined retaining washer. (c)—Rotate the washer until its internal teeth align with the mainshaft splines and slide the washer, gears, sleeve and thrust washers from the shaft.

To assemble, clamp the mainshaft in a vise with its front end up and install the third speed gear rear thrust washer. Then replace the third speed gear and bushing and place the intermediate thrust washer against the third speed gear. Next assemble the fourth

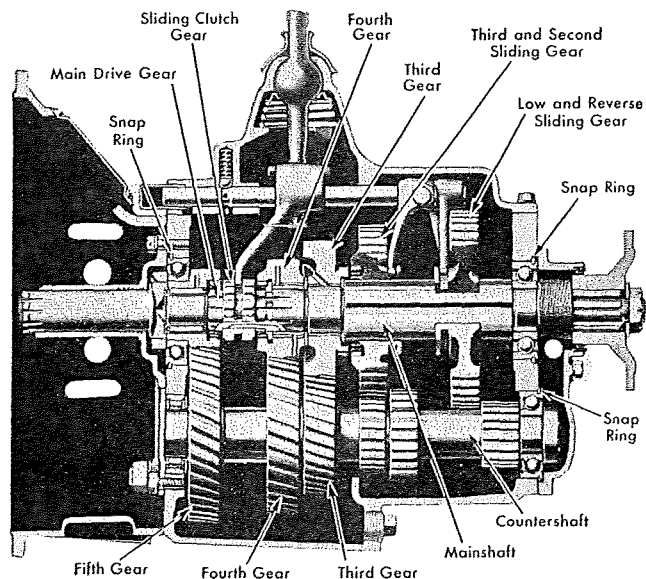


Fig. 109—Group No. 46 Transmission

speed gear and sleeve (fifth gear on overdrive units) and replace the splined washer, locking the assembly in position with the locking key. Slip on the sliding clutch gear and mainshaft front pilot bearing, being sure to lubricate the bearing.

ASSEMBLE

(1)—Assemble the countershaft front bearing, locking it in place with its retainer. (2)—If required, the countershaft helical gears may be replaced by pressing them off one at a time, and when installed, be sure the keys are a tight fit and stake them in place with a prick-punch. (3)—Install the assembly in position but do not replace the bearing and retaining nut until after the mainshaft is in place. (4)—Assemble the reverse gear shaft (or shafts) through the gear (or gears) through the rear. (5)—For units using two reverse speeds, install the high speed reverse shift rail and yoke. (6)—Assemble the main drive gear through the front of the case, replace the bearing retainer and install the clutch release mechanism. NOTE—For the 5-A-620L unit, insert the drive gear through the inside of the case and lock it in position by installing the bearing lock nut. (7)—Insert the mainshaft partly into the case and slip on the sliding gears, placing the larger gear to the rear and with the shift fork channels facing each other. (8)—Push both the mainshaft and countershaft assemblies to the rear at the same time and replace the mainshaft rear bearing and rear countershaft bearing. (9)—Push both assemblies forward again and use new snap rings to hold the bearings in place. (10)—Replace the lock nut on the end of the countershaft and install the mainshaft and counter-

shaft rear bearing retainer caps. (11)—Replace the speedometer drive gear and the universal flange, fastening the flange retaining nut securely. (12)—Install the speedometer driven gear, shift the transmission into first speed and replace the transmission cover assembly. (13)—Connect the hand brake lever.

SHIFTER MECHANISM: (a)—To disassemble, place the rails in the neutral position and remove the shift yoke lock screws. (b)—Drive the rails out of the cover. **CAUTION**—Hold a hand over the lock ball holes to prevent the balls and springs from flying out as the rails are removed. As each rail is removed, it should be tagged to assure correct assembly. (c)—Assemble the cover in the reverse order after lubricating all poppet balls and springs. **NOTE**—Be sure the points of the lock screws engage the holes in the rails before wiring them securely in place. See that all the interlock plunger parts are installed correctly in the center rail.

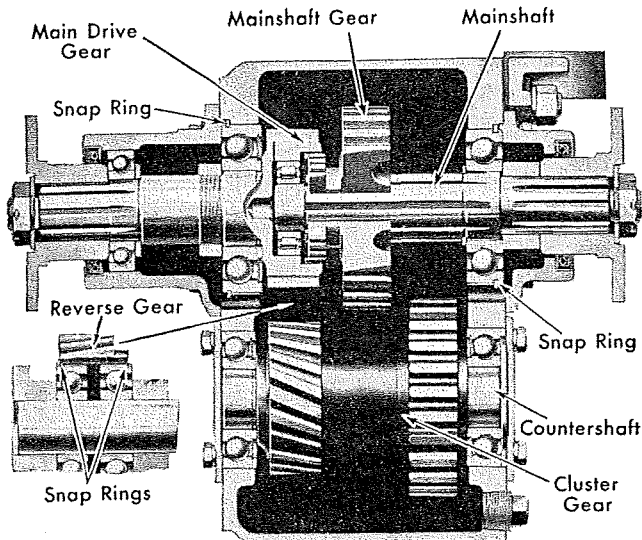


Fig. 110—Group No. 47 Fuller AR

GROUP No. 47

Fig. 110

FULLER TWO-SPEED AUXILIARY AND REVERSING TRANSMISSIONS

Models AR, AR-163, UR, UR-163

NOTE—Model AR and UR transmissions are reversing transmissions while AR-163 and UR-163 are auxiliary units.

DISASSEMBLE

(1)—Remove the transmission cover, loosen the shift yoke lock screw, after which, the shift rail may be withdrawn. (2)—Unfasten the mainshaft rear bearing retainer cap and both countershaft bearing retainer

caps. (3)—Grasp the mainshaft gear, pull the shaft out through the rear and lift out the gear. (4)—Remove the drive gear bearing retainer screws and pull the gear, bearings and retainer out as a unit. (5)—Push the gear out of the retainer. (6)—Unscrew the nut from the shaft and separate the rear bearing from the gear. **NOTE**—The front bearing and oil seal may then be removed from the retainer if necessary. (7)—Tap the countershaft out to the rear and lift out the gears, after which, the bearings may be removed from the case. (8)—To remove the reverse gearing on AR and UR models, pull out the shaft and lift the gears and bearings out of the case. (9)—Assemble in the reverse order.

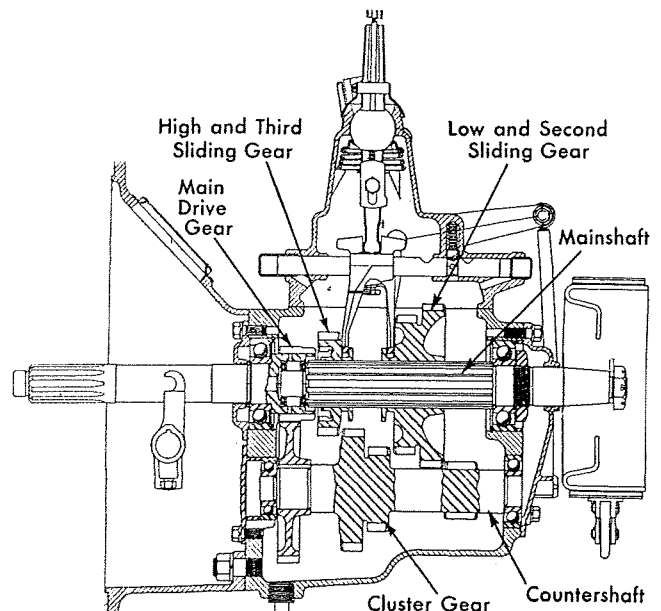


Fig. 111—Group No. 48 Fuller MLU

GROUP No. 48

Fig. 111

FULLER FOUR-SPEED SLIDING GEAR

Models MHU, MKU, MLU, MRU

DISASSEMBLE

(1)—Set the transmission in second gear, remove the cover attaching screws and lift off the cover and shifter assembly. (2)—On MHU and MRU models, disconnect the shift lever housing from the base of the cover. (3)—On all models, take out the thimbles from either end of the cover and set the rails in neutral. (4)—Remove the shift fork lock screws and pull the rails out of the cover, holding a hand over the lock ball holes to prevent the balls and springs from flying out. **CAUTION**—As each rail is removed, it should be tagged to assure correct assembly. (5)—Lock the transmission in two gears to prevent the main-

TRANSMISSION, OVERHAUL

shaft from turning and unscrew the universal flange nut. (6)—Pull off the flange and remove the mainshaft rear bearing retainer. (7)—Grasp the mainshaft sliding gears and withdraw the mainshaft through the rear, then lift the sliding gears out through the top. (8)—The mainshaft rear bearing may be removed from the shaft after removing the speedometer drive gear and unscrewing the nut. (9)—Remove the main drive gear bearing retainer and pull the drive gear assembly out through the front. (10)—The drive gear and bearing may be separated by removing the retaining nut or snap ring—whichever equipped. (11)—Unfasten the countershaft rear bearing cover, push the countershaft to the rear to permit the removal of the rear bearing, after which, lift the countershaft out through the top by its front end. (12)—Pull the reverse gear shaft out of the case and lift out the gear.

ASSEMBLE

(1)—Install the reverse idler gear by pushing the shaft in through the rear. (2)—Assemble the countershaft assembly in the case, replace the rear bearing and install the rear bearing cover. NOTE—With the rear bearing fastened securely, the countershaft should turn freely and should have about .010" end play. (3)—Assemble the main drive gear in through the front and install the drive gear bearing retainer. (4)—Lubricate the mainshaft front pilot bearing and place it in the drive gear pocket. (5)—Install a new snap ring in the rear bearing bore groove (if so equipped); assemble the rear bearing on the mainshaft, retaining it in position with the large nut. (6)—Insert the mainshaft through the rear, passing the sliding gears on at the same time. (7)—Replace the speedometer drive gear and rear bearing retainer. (8)—Replace the universal flange, lock the mainshaft and run the flange nut up tight. (9)—If the cover has been disassembled, assemble in the reverse order, lubricating the balls and springs before replacing; see that the shift fork lock screws engage the holes in the rails before wiring them in place. (10)—Set the gears and cover in second speed position and replace the cover assembly.

GROUP No. 49

Fig. 112

FULLER THREE-SPEED AUXILIARY TRANSMISSION

Models AY, 3AY

NOTE—Model 3AY is used in combination with model MRU four-speed sliding gear transmission.

DISASSEMBLE

(1)—Place the gears in neutral and take off the transmission cover. (2)—Remove the shift rail tension

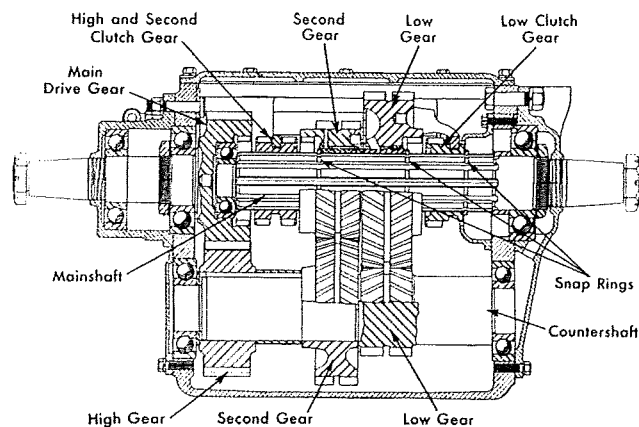


Fig. 112—Group No. 49 Fuller 3AY Auxiliary Transmission

spring cover and the screws from the shift yokes. (3)—Pull out the shift rails, upper one first, and lift the yokes from the case. NOTE—Care must be exercised when removing the rails to see that none of the small rail parts are lost. (4)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the nuts from the front and rear ends of the mainshaft, then pull off both companion flanges. (5)—Disconnect the rear bearing retainer cover from the transmission. (6)—Unscrew the rear bearing retainer nut and remove the rear bearing, bearing spacer and speedometer gears. (7)—Unfasten the speedometer gear housing from the inside of the case. (8)—Jerk the mainshaft to the rear to release the pilot bearing, then lift the mainshaft up to unmesh the herringbone gears, pull the mainshaft to the rear, tilt the front end up and lift it out of the case. (9)—Remove the drive gear bearing cover, push the drive gear and bearing assembly into the transmission and lift it out from the inside. (10)—Separate the gear and bearing by removing the retainer nut; the drive gear front bearing may be removed from the retainer cover if required. (11)—Push the countershaft to the rear, remove the rear bearing and lift out the assembly by its front end.

NOTE—The mainshaft may be disassembled by removing the sliding clutch gear, after which, the gears and sleeves may be removed by releasing the snap rings. If necessary, press the countershaft gears from the shaft one at a time, and when installed, be sure the keys are a tight fit and properly staked in place.

ASSEMBLE

(1)—Assemble the countershaft front bearing in the case. (2)—Place the countershaft assembly in the case, push it to the rear and install the rear bearing. (3)—Assemble the main drive gear through the inside of the

case and replace the drive gear retainer. (4)—Lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (5)—Assemble the mainshaft in the reverse order of removal, replacing the speedometer gears before installing the rear bearing. (6)—Fasten the rear bearing cover to the transmission, install the companion flanges, lock the mainshaft and tighten the flange nuts securely. (7)—Assemble the shift rails and forks in the reverse order of removal, then attach the transmission cover.

GROUP No. 50

Fig. 113

BROWN-LIPE FOUR-SPEED CONSTANT MESH

Models 3241, 3341, 3440, 5341, 7341

DISASSEMBLE

(1)—Disconnect the hand brake lever and control linkage. (2)—Take off the transmission cover and lock the gears in two speeds to prevent the mainshaft from turning in order to remove the universal flange nut. (3)—Use a puller if necessary, to remove the flange. (4)—Unfasten the mainshaft rear bearing retainer cap, countershaft bearing cap and take off the bell housing. (5)—Unscrew the bolt from the rear end of the countershaft and the nut from the front end. (6)—Remove the drive gear bearing retainer and withdraw the gear and bearing assembly through the front. (7)—Push the mainshaft far enough to the rear to permit the removal of the rear bearings. (8)—Tilt the forward end of the mainshaft upward and lift it out through the top. (9)—Remove the reverse fork stud and lift out the fork. (10)—Take out the lock screw, pull out the reverse idler gear shaft and lift out the gear. (11)—Push the countershaft far enough to the rear to permit the rear bearing to be removed. (12)—Tilt the forward end of the assembly upward and lift it out.

MAINSHAFT: (a)—To disassemble, slip the sliding gears and the sliding clutch gear from the mainshaft. (b)—Pull the T-shaped key from the slot in the shaft and disengage its point from the thrust washer. (c)—Rotate the thrust washer to align its internal teeth with the mainshaft splines and remove it from the shaft. (d)—Slide the third speed gear from the shaft, being careful not to lose any of the roller bearings.

NOTE—To assemble, clamp the mainshaft in a vise with its front end up and place the third speed gear on the shaft. Assemble the rollers in the bore of the gear, using grease to hold them in position. Replace the thrust washer, lining up its teeth with the mainshaft splines. Engage the end of the T-shaped key in the thrust washer—which prevents the washer from turning—and push the key into the slot of the shaft. The sliding gears and sliding clutch gear may now be installed.

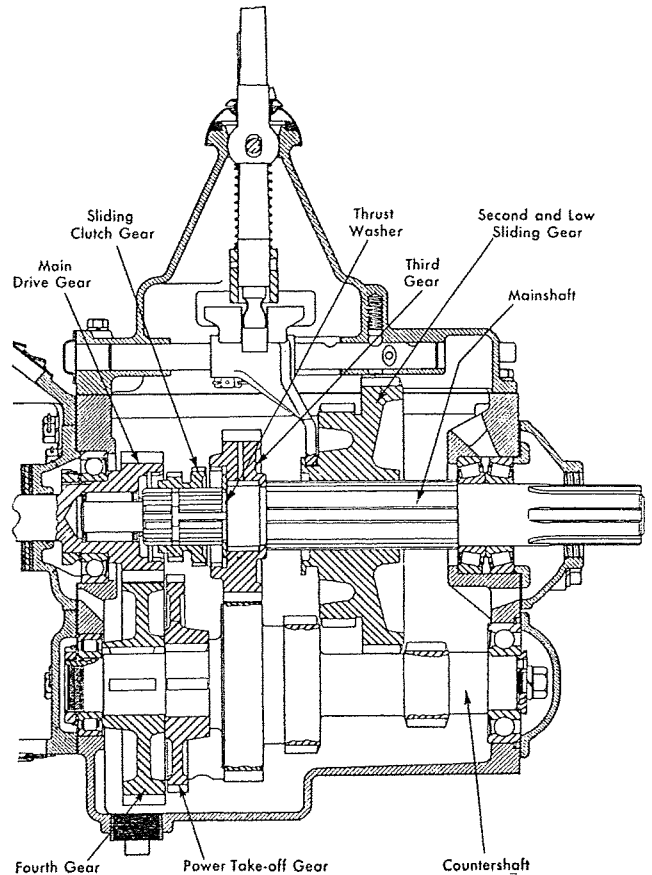


Fig. 113—Group No. 50 Brown-Lipe 5341

ASSEMBLE

NOTE—When assembled in the case, the mainshaft end play should not exceed .003" and is controlled by shims under the rear bearing retainer cap. Shims of various thicknesses are available to obtain this end play.

(1)—If required, the countershaft helical gears may be replaced, and when install, be sure the keys are a tight fit and stake them in place with a prick-punch. (2)—Place the countershaft assembly in position and install the front and rear bearings, locking them in position by replacing the bolt and washer at the rear and the nut at the front. (3)—Assemble the reverse idler gear and shaft and install the lock screw. (4)—Install the reverse fork and shaft, being sure the set screw engages the hole in the shaft. (5)—Replace the mainshaft assembly and install the rear bearings. (6)—Assemble the main drive gear assembly in position, using a new snap ring to hold the front bearing in place. (7)—Complete the assembly by installing the bearing retainers, bell housing, universal flange and nut, hand brake lever and the transmission cover assembly.

SHIFTER MECHANISM: If necessary to disassemble, remove the shift fork lock screws and drive the rails out through the front. **CAUTION**—Hold a

TRANSMISSION, OVERHAUL

hand over the lock ball holes to prevent the balls and springs from flying out as the rails are removed; as each rail is removed, it should be tagged to assure correct assembly.

Assemble in the reverse order, lubricating the balls and springs before replacing. Be sure that the lock screws engage the holes in the rails, and that the interlock plungers are correctly installed in the center rail.

GROUP No. 51

Fig. 114

BROWN-LIPE FOUR-SPEED CONSTANT MESH

Models B-341, 2341

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Remove the speedometer driven gear. (3)—Disconnect the hand brake mechanism and remove the hand brake band. (4)—Engage the second and low speed gears to prevent the mainshaft from turning and unscrew the nut from the rear end of the mainshaft. (5)—Use a puller if necessary, to remove

drive gear to be removed. (10)—Tilt the front end of the mainshaft upward and lift the assembly out through the top. (11)—Remove the countershaft rear bearing retainer cap and release the snap ring from the inner race of the bearing. (12)—Push the countershaft far enough to the rear to permit the rear bearing to be removed. (13)—Tilt the front end of the countershaft upward and lift it out of the case.

NOTE—The fourth and third speed gears can be replaced by pressing them off one at a time after removing the snap ring, and when installed, be sure the keys are a tight fit and stake them in place with a prick-punch. (14)—Remove the reverse idler shaft lock, tap the shaft out through the rear and lift out the gear.

MAINSHAFT: To disassemble, slip the sliding gears from the shaft. Release the snap ring from in front of the third speed gear, rotate the thrust washer until its teeth register with the mainshaft splines and remove the washer and third speed gear.

NOTE—Assemble in the reverse order, using a new snap ring, and if the washer shows evidence of excessive wear, install a new one.

SHIFTER MECHANISM: If necessary to disassemble, drive out the expansion plugs at the front of the cover. With the shift rails in neutral, remove the set screws from the shift forks and push the rails out toward the front, holding a hand over the lock ball holes to prevent the balls and springs from flying out. **CAUTION**—As each rail is removed, it should be tagged to assure correct assembly.

Assemble the cover in the reverse order, lubricating the balls and springs before replacing. See that the interlock plungers are installed properly in the center rail, and that the lock screws are engaged in the holes in the shift rails before wiring them in place.

ASSEMBLE

(1)—Assemble the reverse idler gear and push the shaft in through the rear. (2)—Install the countershaft front bearing. (3)—Place the countergear assembly in the case and install the rear bearing, using new snap rings to retain the bearing and shaft. (4)—Lubricate the mainshaft splines and slip the sliding gears on the shaft with the larger gear to the rear. (5)—Assemble the mainshaft in the case and replace the rear bearing, locking it in position with a new snap ring. (6)—Install the speedometer drive gear and rear bearing retainer, replacing the oil seal if excessive wear is evident. (7)—Slip the sliding clutch gear on the shaft, lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (8)—Install the drive gear assembly through the front, using a new snap ring in the bearing groove. (9)—Replace the drive gear bearing retainer and bell housing. (10)—Lock the transmission in two gears, install the universal flange and tighten the flange nut securely. (11)—Complete the assembly by installing the speedometer driven gear, then place the gears in neutral and assemble the transmission cover and hand brake mechanism.

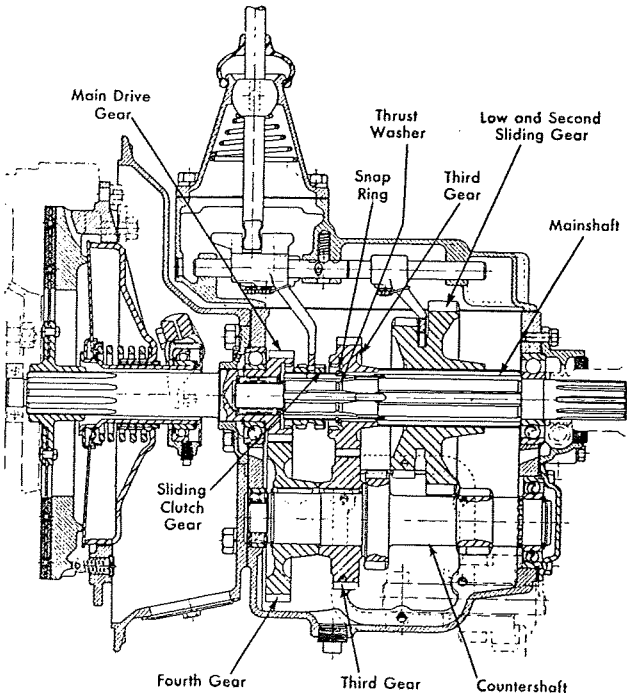


Fig. 114—Group No. 51 Brown-Lipe 2341

the universal flange. (6)—Disconnect the mainshaft rear bearing retainer. (7)—Remove the bell housing and main drive gear bearing retainer. (8)—Withdraw the main drive gear assembly through the front of the case. (9)—Slip the sliding clutch gear from the front of the mainshaft and push the mainshaft to the rear far enough to permit the rear bearing and speedometer

GROUP No. 52

Fig. 115

BROWN-LIPE FOUR-SPEED ALL HELICAL
GEAR TRANSMISSION

Model 2441

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Remove the speedometer driven gear. (3)—Remove the hand brake mechanism. (4)—Lock the transmission in two gears to prevent the mainshaft from turning and remove the universal flange nut. (5)—Use a puller if necessary, to take off the flange. (6)—Unfasten the mainshaft rear bearing retainer. (7)—Remove the bell housing and main drive gear bearing retainer. (8)—Withdraw the drive gear assembly through the front of the case. (9)—Slip the sliding clutch gear from the front of the mainshaft and push the mainshaft to the rear far enough to permit the removal of the speedometer drive gear and rear bearing. (10)—Tilt the front end of the mainshaft upward and lift the assembly out through the top. (11)—Remove the countershaft rear bearing retainer cap and unscrew the two bolts which retain the rear bearing. (12)—Push the countershaft to the rear far enough to permit the rear bearing to be removed. (13)—Tilt the front end of the countershaft upward and lift the assembly out of the case.

NOTE—The fourth and third speed gears and (if equipped) the power take-off gear can be replaced by pressing them off one at a time, and when installed, be sure the keys are a tight fit and stake them in place with a prick-punch. (14)—Push out the reverse idler shaft and lift out the gear.

MAINSHAFT: To disassemble, slip off the sliding gear. Release the snap ring from in front of the third speed gear and remove the thrust washer and third speed gear from the shaft.

NOTE—Assemble in the reverse order, using a new snap ring, and if the thrust washer shows evidence of excessive wear, install a new one.

SHIFTER MECHANISM: If necessary to disassemble, drive out the expansion plugs at the front of the cover. Place the shift rails in neutral and remove the shift fork lock screws. Push the rails out through the front, holding a hand over the lock ball holes to prevent the balls and springs from flying out. **CAUTION**—As each rail is removed, it should be tagged to assure correct assembly.

Assemble the cover in the reverse order, lubricating the balls and springs before replacing. See that the interlock plungers are installed correctly in the center rail, and that the lock screws engage the holes in the shift rails before wiring them in place.

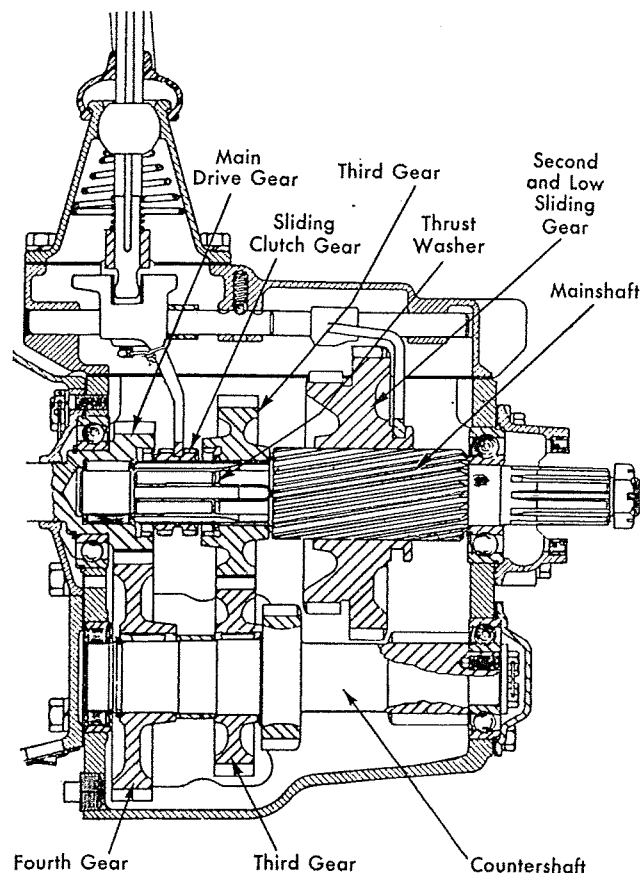


Fig. 115—Group No. 52 Brown-Lipe 2441

ASSEMBLE

(1)—Assemble the reverse idler gear and push the shaft in through the rear. (2)—Install the countershaft front bearing. (3)—Place the countergear assembly in the case and install the rear bearing, installing the two cap screws and washer securely, using wire to lock them in place; use a new snap ring in the bearing groove. (4)—Lubricate the mainshaft splines and slip on the sliding gears, facing the larger gear to the rear. (5)—Assemble the mainshaft in the case and replace the rear bearing, locking it in position with a new snap ring. (6)—Install the speedometer drive gear and rear bearing retainer, replacing the oil seal if excessive wear is evident. (7)—Slip the sliding clutch gear on the shaft, lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (8)—Install the drive gear assembly through the front, using a new snap ring in the bearing groove. (9)—Replace the drive gear bearing retainer and bell housing. (10)—Lock the transmission in two gears, install the universal flange and tighten the flange nut securely. (11)—Complete the assembly by replacing the speedometer driven gear, then place the gears in neutral and assemble the transmission cover and hand brake mechanism.

GROUP No. 53

BROWN-LIPE FOUR-SPEED CONSTANT MESH

Model 224

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Remove the speedometer driven gear. (3)—Disconnect the hand brake mechanism. (4)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (5)—Use a puller if necessary, to remove the flange and brake drum. (6)—Unfasten the mainshaft rear bearing retainer. (7)—Remove the bell housing and drive gear bearing retainer. (8)—Withdraw the drive gear and bearing assembly through the front of the case. (9)—Push the mainshaft to the rear far enough to permit the removal of the speedometer drive gear and rear bearing. (10)—Tilt the front end of the assembly upward and lift it out through the top. (11)—Drive the locking plate from the slots of the countershaft and reverse idler shaft, pull the shafts out through the rear and lift out the gears.

MAINSHAFT: To disassemble, slip off the sliding gear, remove the sliding clutch sleeve and clutch gear and take off the third speed gear.

SHIFTER MECHANISM: Remove the shift fork lock screws and push out the rails, holding a hand over the lock ball holes to prevent the balls and springs from flying out. **CAUTION**—As each rail is removed, it should be tagged to assure correct assembly.

When assembling the cover, lubricate the balls and springs before replacing and be sure that the lock screws engage the holes in the rails. See that the interlock plungers are correctly assembled in the center rail.

ASSEMBLE

(1)—Assemble the reverse idler gear and push the shaft in through the rear. (2)—Install the bearings and spacer in the countergear and place the assembly in the case, pushing the countershaft in through the rear. (3)—With the slots of reverse idler shaft and countershaft facing each other, drive the lock plate in position and lock it securely with the cap screw. (4)—Lubricate the mainshaft splines and assemble the gears in the reverse order of their removal and install in the case. (5)—Install the rear bearing retainer. (6)—Assemble the drive gear and bearing in position and replace the drive gear bearing retainer. (7)—Replace the speedometer drive gear and universal flange. (8)—Lock the transmission in two gears and fasten the flange nut securely. (9)—Replace the speedometer driven gear, assemble the transmission cover and connect the hand brake mechanism.

GROUP No. 54

Fig. 116

BROWN-LIPE FOUR-SPEED SLIDING GEAR

Model 234

DISASSEMBLE

(1)—Remove the transmission cover and shifter assembly. (2)—Remove the speedometer driven gear. (3)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (4)—Use a puller if necessary, to remove the flange and brake drum. (5)—Unfasten the mainshaft rear bearing retainer. (6)—Remove the bell housing and the main drive gear bearing retainer. (7)—Pull the drive gear and bearing assembly out through the front. (8)—Push the mainshaft to the rear until the rear bearing is free of the case. (9)—Grasp the sliding gears and withdraw the mainshaft out through the rear and lift out the gears. (10)—Remove the lock bolt and drive the lock plate from the slots of the reverse idler shaft and countershaft. (11)—Pull the shafts out through the rear and lift out the gear assemblies.

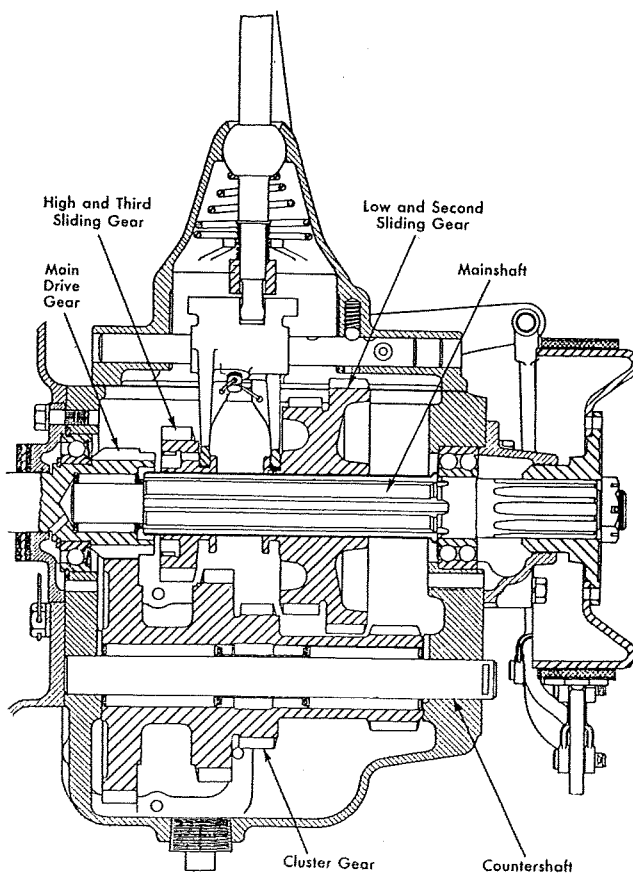


Fig. 116—Group No. 54 Brown-Lipe 234

ASSEMBLE

(1)—Assemble the reverse idler gear and countershaft assembly and install the lock plate in the slots in the ends of the shafts. (2)—Insert the mainshaft through the rear, passing it through the sliding gears. (3)—Install the mainshaft rear bearing on the shaft, pushing it against the shoulder on the mainshaft, after which, fasten the retainer securely in position. (4)—Replace the drive gear and bearing assembly, using new snap rings to hold the bearing in the proper position. (5)—Install the drive gear bearing retainer and the bell housing. (6)—Replace the speedometer drive gear and universal flange, lock the transmission in two gears and install the universal flange nut securely. (7)—Assemble the speedometer driven gear. (8)—Install the transmission cover assembly.

SHIFTER MECHANISM: If necessary to disassemble, remove the shift fork lock screws and push out the rails, holding a hand over the lock ball holes to prevent the balls and springs from flying out. **CAUTION**—As each rail is removed, it should be tagged to assure correct assembly. When assembling the cover, lubricate the balls and springs before replacing, and be sure the lock screws engage the holes in the rails. See that the interlock plungers are installed correctly in the center rail.

GROUP No. 55

Fig. 117

BROWN-LIPE THREE-SPEED SILENT MESH

Model 5331

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (3)—Use a puller to remove the universal flange. (4)—Remove the speedometer driven gear and mainshaft rear bearing retainer. (5)—Push the mainshaft far enough to the rear to permit the removal of the speedometer drive gear and rear bearing. (6)—Tilt the front end of the shaft upward and lift the assembly out through the top. (7)—Remove the bell housing and the main drive gear bearing retainer and unscrew the drive gear lock nut. (8)—Use a soft hammer to tap the drive gear into the transmission and lift it out from the inside. (9)—The drive gear bearing may now be removed from the case. (10)—Take off the countershaft rear bearing cap and unscrew the lock nut from the rear end of the countershaft. (11)—Tap the countershaft far enough to the rear to permit the removal of the rear bearing. (12)—Tilt the front end of the countershaft upward and lift it out. (13)—Push the reverse idler shaft out through the rear and lift out the gear.

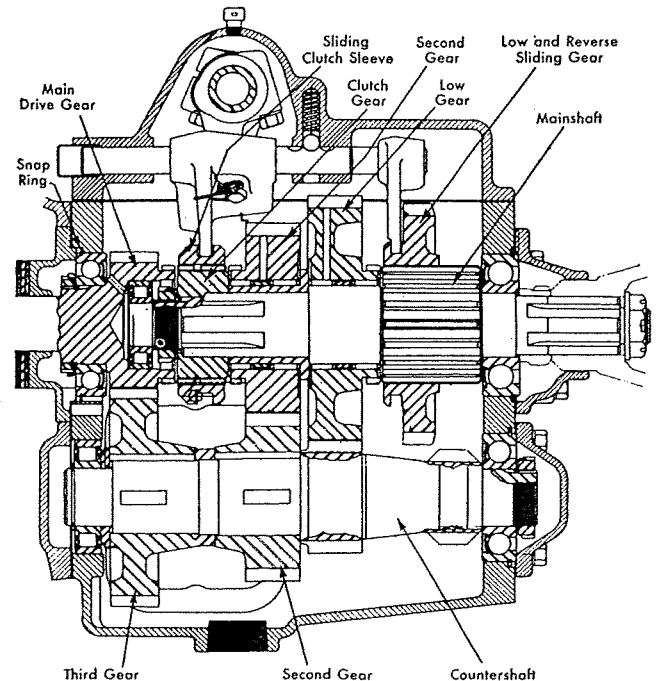


Fig. 117—Group No. 55 Brown-Lipe 5331

MAINSHAFT: (a)—To disassemble, slip the sliding gear from the shaft. (b)—Unscrew the nut from the front end of the shaft. (c)—The shaft may now be removed by pressing off the gears.

NOTE—Before disassembling the shaft, note carefully the arrangement of the gears to assure correct assembly.

SHIFTER MECHANISM: If necessary to disassemble, remove the shift fork lock screws and push the rails out forward, forcing the thimbles out at the same time. **CAUTION**—Hold a hand over the lock ball holes to prevent the balls and springs from flying out, and as each rail is removed, it should be tagged so that assembly may be made correctly. Assemble in the reverse order, lubricating the balls and springs before replacing. See that the lock screws engage the holes in the rails and that the interlock plunger is installed correctly.

ASSEMBLE

(1)—Assemble the reverse idler gear and push the shaft in through the rear. (2)—The high and second speed countershaft gears may be replaced by pressing them from the shaft one at a time; and when installed, be sure the keys are a tight fit and stake them in place with a punch. (3)—Place the assembly in position and install the rear bearing, using a new snap ring. (4)—Replace the nut on the rear end of the countershaft and install the retainer cap, being sure to engage the cap in the slot of the reverse idler gear shaft.

TRANSMISSION, OVERHAUL

(5)—Assemble the main drive gear bearing in the bore of the case, using a new snap ring. (6)—Insert the drive gear from the inside of the case and lock it in position with the nut and washer. (7)—Lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (8)—Fasten the drive gear retainer cap securely to the case and install the bell housing. (9)—Assemble the mainshaft in the reverse order of removal and install it in the case. (10)—Replace the mainshaft rear bearing, using a new snap ring. (11)—Install the speedometer drive gear and mainshaft rear bearing retainer. (12)—Replace the universal flange, lock the transmission in two gears and draw the flange nut up tight. (13)—Install the speedometer driven gear and assemble the transmission cover.

GROUP No. 56

Fig. 118

BROWN-LIPE FIVE-SPEED OVERDRIVE CONSTANT MESH

Model 5351

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (3)—Take out the speedometer driven gear. (4)—Use a puller if necessary, to remove the universal flange. (5)—Unfasten the retainer cap from the rear of the case and remove the speedometer drive gear and rear bearing retainer. (6)—Pull the overdrive shift shaft out through the rear and lift out the fork. (7)—Remove the overdrive housing countershaft cover and unscrew the lock bolts which retain the overdrive gears to the countershaft. (8)—Reach into the overdrive housing and remove the bolts which fasten this housing to the main case. (9)—Pull the overdrive housing and gears to the rear, and at the same time, force the rear bearing from the mainshaft. (10)—Remove the bell housing and the main drive gear bearing cap and pull the drive gear assembly out through the front.

NOTE—If necessary, the gear and bearing may be separated after unscrewing the bearing retainer nut. (11)—Slip the sliding clutch gear from the shaft and take it out through the drive gear bore. (12)—Tap the mainshaft to the rear until the mainshaft intermediate bearing is free of the recess in the housing. (13)—Pull the T-shaped key from the slot in the mainshaft and disengage it from the third speed gear thrust washer. (14)—Withdraw the mainshaft through the gears and out of the case through the rear, after which, lift the loose gears from the case. (15)—Unscrew the nut from the front end of the countershaft. (16)—Push the countershaft far enough to the rear to permit

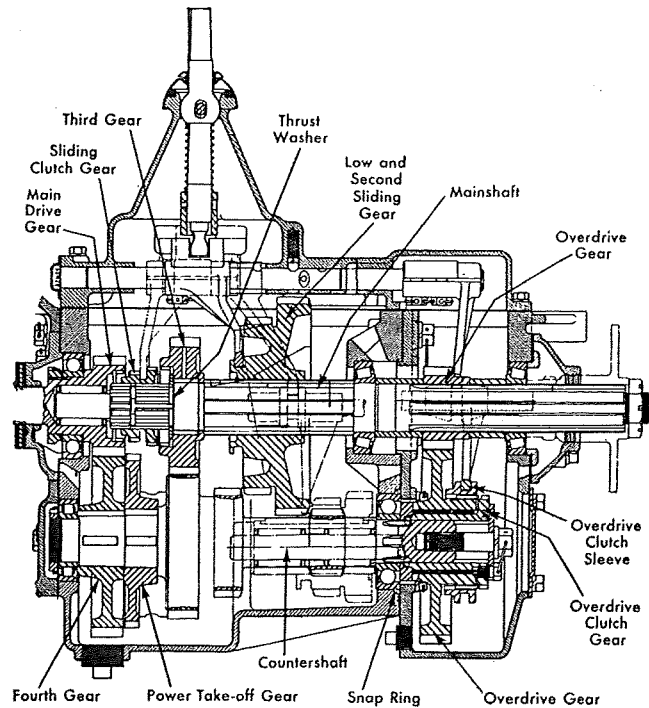


Fig. 118—Group No. 56 Brown-Lipe 5351

the removal of the rear bearing. (17)—Tilt the front end of the assembly upward and lift it out. (18)—Pull the reverse idler shaft out through the rear and lift out the gear.

SHIFTER MECHANISM: If necessary to disassemble the cover, remove the shift fork lock screws and drive the rails out through the front. **CAUTION**—Hold a hand over the lock ball holes to prevent the balls and springs from flying out. As each rail is removed, it should be tagged to assure correct assembly. When assembling, lubricate the balls and springs, and make sure the lock screws engage the holes in the rails. See that the interlock plungers are assembled correctly.

ASSEMBLE

(1)—Assemble the reverse idler gear and push the shaft in through the rear. (2)—Install the countershaft front bearing and assemble the countershaft assembly in the case, then replace the countershaft rear bearing, using a new snap ring in the bearing groove. (3)—Screw the retaining nut securely on the front end of the countershaft. (4)—Hold the mainshaft gears in the case and insert the mainshaft through the rear, passing it through the gears. (5)—Install the mainshaft intermediate bearing on the shaft, pushing it against the shoulder on the mainshaft and into the recess of the case. (6)—Position the third speed gear and thrust washer, engage the point of the T-shaped key into the thrust washer to lock it in place,

then push the key into the slot of the mainshaft. (7)—Slip the sliding clutch gear through the drive gear bore and push it in position. (8)—Lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (9)—Install the main drive gear assembly through the front and fasten the retainer to the case, then install the bell housing. (10)—Install the spacer sleeve behind the mainshaft intermediate bearing, then replace the overdrive mainshaft gear, pushing it against the sleeve, after which, the rear spacer sleeve is placed on the shaft up against the overdrive gear. (11)—Assemble the overdrive countershaft gear and hold them in their relative position in the housing, then pass the housing over the rear end of the mainshaft, working the gears over the countershaft as the housing is pushed forward. (12)—Install the cap screws which connect the overdrive housing to the main case. (13)—Install the washers and bolts which retain the overdrive gears to the countershaft, wiring the bolts in place after they are fastened securely. (14)—Replace the mainshaft rear bearing and its retainer. (15)—Install the speedometer drive gear and the rear retainer cover, after which, push in the universal flange. (16)—Lock the transmission in two gears and run the universal flange nut up tight. (17)—Replace the speedometer driven gear and the countershaft rear cover. (18)—Assemble the overdrive shift rail and fork in the overdrive housing. (19)—Set the gears in neutral and replace the transmission cover.

GROUP No. 57

Fig. 119

BROWN-LIPE FIVE-SPEED CONSTANT MESH

Model 5352

DISASSEMBLE

(1)—Remove cover and shifter assembly. (2)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (3)—Take out the speedometer driven gear. (4)—Use a puller if necessary, to remove the universal flange. (5)—Unfasten the retainer cap from the rear of the case, remove the speedometer drive gear and rear bearing retainer. (6)—Reach into the low gear housing and remove the bolts which fasten this housing to the main case. (7)—Pull the low gear housing and the mainshaft low gear to the rear, and at the same time, force the rear bearing from the mainshaft. (8)—Remove the bell housing and the main drive gear bearing cap and pull the drive gear assembly out through the front. NOTE—If necessary, the gear and bearing may be separated after unscrewing the bearing retainer nut. (9)—Slip the sliding clutch gear from the shaft and take it out through the drive gear bore.

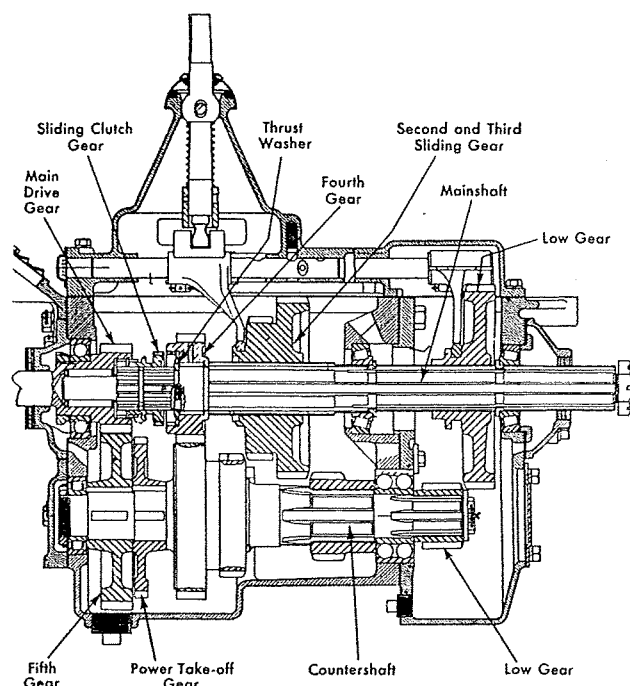


Fig. 119—Group No. 57 Brown-Lipe 5352

(10)—Tap the mainshaft to the rear until the mainshaft intermediate bearing is free of the recess in the housing. (11)—Use a suitable pointed tool to depress the fourth speed gear thrust washer plunger. (12)—With the plunger depressed, rotate the thrust washer to align its teeth with the mainshaft splines and slide the washer and gear toward the front of the shaft. NOTE—Use care when sliding off the gear that the plunger does not stick in the oil hole. (13)—Withdraw the mainshaft through the gears and out of the case through the rear, after which, lift the loose gears from the case. (14)—Unscrew the nut from the front end of the countershaft. (15)—Take out the two bolts from the rear end of the countershaft, remove the retainer and pull the low speed gear from the shaft. (16)—Force the countershaft far enough to the rear to permit the removal of the rear bearing. (17)—Tilt the front end of the assembly upward and lift it out through the top. (18)—Pull the reverse idler shaft out through the rear and lift out the gear.

SHIFTER MECHANISM: If necessary to disassemble the cover, remove the shift fork lock screws and drive the rails out through the front. CAUTION—Hold a hand over the lock ball holes to prevent the balls and springs from flying out. As each rail is removed, it should be tagged to assure correct assembly. When assembling, lubricate the balls and springs and make sure the lock screws engage the holes in the rails. See that the interlock plungers are assembled correctly.

TRANSMISSION, OVERHAUL

ASSEMBLE

(1)—Assemble the reverse idler gear and push the shaft in through the rear. (2)—The fifth speed countershaft and the power take-off gear may be removed by pressing them off the shaft one at a time, and when installed, be sure the keys are a tight fit and stake them in place with a prick-punch. (3)—Replace the countershaft front bearing, install the countershaft assembly and replace the rear bearing, using a new snap ring in the bearing groove. (4)—Slip the low speed gear on the rear end of the countershaft, replace the retainer, fastening the gear and retainer securely with the two lock bolts. (5)—Run the lock nut up tight on the front end of the countershaft. (6)—Insert the mainshaft through the rear of the case, passing it through the sliding gears. (7)—Assemble the fourth speed gear and thrust washer on the shaft, being sure to install the plunger. NOTE—Hold the plunger down and slide the gear and thrust washer in position, depress the plunger again and rotate the washer to permit the plunger to lock it in place. (8)—Install the mainshaft intermediate bearing and slip on the sliding clutch gear. (9)—Lubricate the mainshaft pilot bearing and insert it in the drive gear pocket. (10)—Install the drive gear assembly through the front and replace the front retainer cap and the bell housing. (11)—Hold the mainshaft low speed gear in the low gear housing and pass the gear and housing over the rear end of the mainshaft. (12)—Install the cap screws which fasten the low gear housing to the main case. (13)—Replace the mainshaft rear bearing, its retainer and the speedometer drive gear. (14)—Attach the rear retainer cap, push the universal flange in position, lock the mainshaft in two gears and fasten the flange nut securely. (15)—Replace the speedometer driven gear and install the transmission cover assembly.

GROUP No. 58

Fig. 120

BROWN-LIPE FIVE-SPEED CONSTANT MESH

Models 2252, 2253, 2352, 2353

DISASSEMBLE

NOTE—Models 2252 and 2352 are units with direct drive in fifth gear, while 2253 and 2353 are overdrive units with direct in fourth. Models 2352 and 2353 transmissions are equipped with two reverse speeds.

(1)—Remove the hand brake lever. (2)—Shift the transmission into first speed and lift off the transmission cover and shifter assembly. (3)—Remove the universal flange nut and pull off the flange. (4)—Take off the mainshaft and countershaft rear bearing retainer caps. (5)—Unscrew the lock nut from the rear

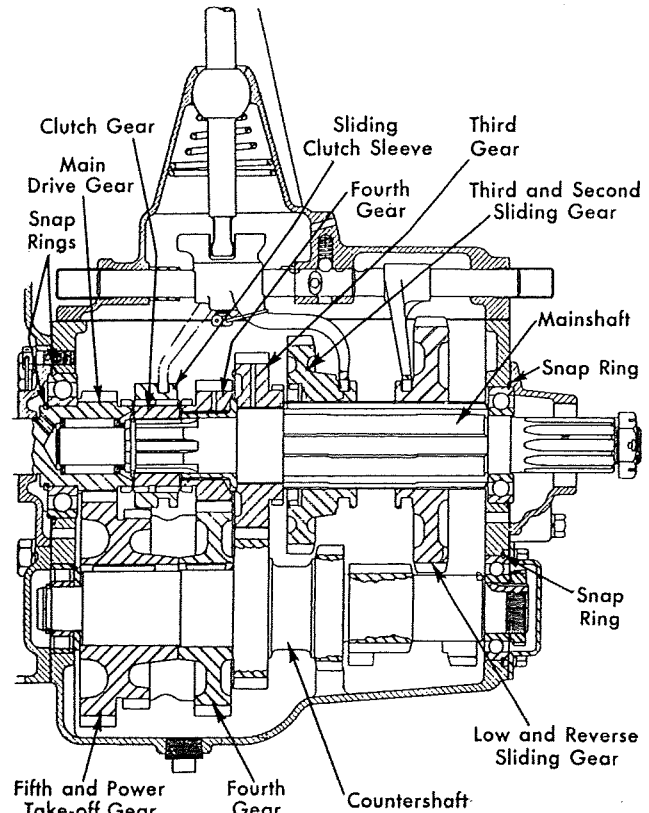


Fig. 120—Group No. 58 Brown-Lipe 2252, 2253

end of the countershaft. (6)—Push both the mainshaft and countershaft assemblies to the rear at the same time until the mainshaft rear bearing is clear of the case, then pull off the bearing. (7)—Tilt the front end of the mainshaft upward, grasp the sliding gears and pull the mainshaft with the stationary gears out through the top, after which, lift out the sliding gears. (8)—Remove the clutch release mechanism and take off the main drive gear bearing retainer. (9)—Withdraw the drive gear assembly out through the front. (10)—On models equipped with two reverse speeds, take out the high speed reverse shift rail and yoke. (11)—On all units, withdraw the reverse gear shaft (or shafts) and remove the reverse gear (or gears) from the case. (12)—Push the countershaft to the rear far enough to permit the rear bearing to be removed and tilt the front end of the assembly upward and lift it out. (13)—The front bearing may be removed after removing its retainer.

MAINSHAFT: (a)—To disassemble, remove the mainshaft pilot bearing and sliding clutch sleeve from the mainshaft. (b)—Remove the snap ring which retains the sliding clutch gear and slide the gears, sleeve, and thrust washers from the shaft.

To assemble, clamp the mainshaft in a vise with its front end up and install the third speed gear rear

thrust washer. Then replace the third speed gear and bushing against the third speed gear. Next assemble the fourth speed gear and sleeve (fifth gear on overdrive units) and replace the sliding clutch gear, locking the assembly in position with the snap ring. Slip on the sliding clutch sleeve and mainshaft front pilot bearing, being sure to lubricate the bearing.

ASSEMBLE

(1)—Assemble the countershaft front bearing, locking it in place with its retainer. (2)—If required, the countershaft helical gears may be replaced by pressing them off one at a time, and when installed, be sure the keys are a tight fit and stake them in place with a prick-punch. (3)—Install the assembly in position but do not replace the bearing and retaining nut until after the mainshaft is in place. (4)—Assemble the reverse gear thrust (or shafts) through the gear (or gears) through the rear. (5)—For units using two reverse speeds, install the high speed reverse shift rail and yoke. (6)—Assemble the main drive gear through the front of the case, replace the bearing retainer and install the clutch release mechanism. (7)—Insert the mainshaft partly into the case and slip on the sliding gears, placing the larger gear to the rear and with the shift fork channels facing each other. (8)—Push both the mainshaft and countershaft assemblies to the rear at the same time and replace the mainshaft rear bearing and rear countershaft bearing. (9)—Push both assemblies forward again and use new snap rings to hold the bearings in place. (10)—Replace the lock nut on the end of the countershaft and install the mainshaft and countershaft rear bearing retainer caps. (11)—Replace the speedometer drive gear and the universal flange, fastening the flange retaining nut securely. (12)—Install the speedometer driven gear, shift the transmission into first speed and replace the transmission cover assembly. (13)—Connect the hand brake lever.

SHIFTER MECHANISM: (a)—To disassemble, place the rails in the neutral position and remove the shift yoke lock screws. (b)—Drive the rails out of the cover. **CAUTION**—Hold a hand over the lock ball holes to prevent the balls and springs from flying out as the rails are removed. As each rail is removed, it should be tagged to assure correct assembly. (c)—Assemble the cover in the reverse order after lubricating all poppet balls and springs. **NOTE**—Be sure the points of the lock screws engage the holes in the rails before wiring them securely in place. See that all the interlock plunger parts are installed correctly in the center rail.

GROUP No. 59

Fig. 121

BROWN-LIPE EIGHT-SPEED CONSTANT MESH

Model 3481

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (3)—Use a puller if necessary, to remove the universal flange. (4)—Remove the speedometer driven gear and disconnect the mainshaft and countershaft covers from the auxiliary housing.

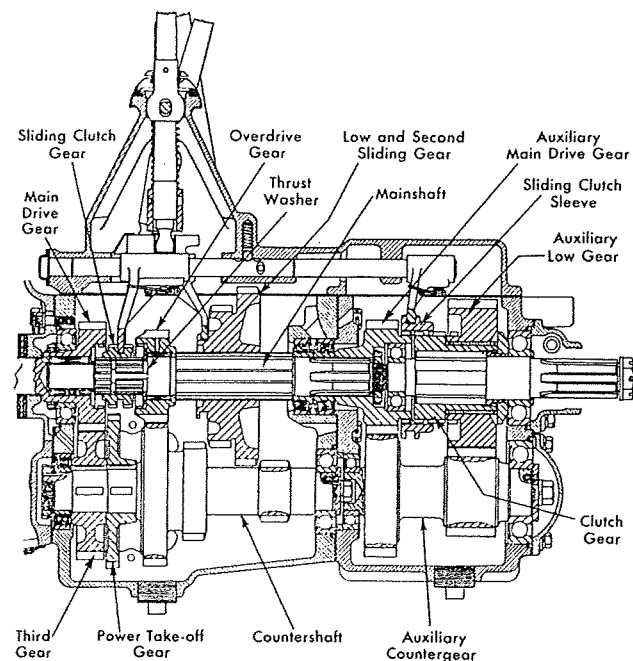


Fig. 121—Group No. 59 Brown-Lipe 3481

(5)—Remove the speedometer drive gear and washer from the auxiliary mainshaft. (6)—Take out the cap screw and washer from the auxiliary countershaft. (7)—Grasp the auxiliary mainshaft gears and pull the mainshaft out through the rear, forcing the auxiliary mainshaft bearing out at the same time, then lift the loose gears from the housing. (8)—Take the auxiliary mainshaft pilot bearing from the pocket of the drive gear, lock the mainshaft in two gears and remove the nut from the end of the mainshaft, after which, the auxiliary main drive gear may be removed. (9)—Reach into the auxiliary housing and unscrew the bolts which fasten this housing to the main case. (10)—Remove the auxiliary housing from the main case. **NOTE**—If necessary, the auxiliary countershaft may be removed at this point by forcing the shaft far enough to the rear until the rear bearing is clear of the case,

TRANSMISSION, OVERHAUL

after which, the gear assembly may be lifted out by its front end. (11)—Push the mainshaft far enough to the rear to permit the removal of the rear bearings. (12)—Slip the sliding clutch gear forward on the mainshaft to gain access to the T-shaped key in the slot of the mainshaft. (13)—Pull the key out of the slot and disengage its end from the fourth speed gear thrust washer. (14)—Rotate the washer to align its teeth with the mainshaft splines and slide it forward. (15)—Pull the mainshaft to the rear, picking off the gears as the shaft is withdrawn. (16)—Remove the bell housing and the main drive gear cover and push the drive gear assembly into the case and lift it out through the top. NOTE—If necessary the drive gear and bearing may be separated after unscrewing the bearing retainer nut. (17)—Unscrew the nut from the front end of the shaft. (18)—Force the countershaft far enough to the rear to permit the removal of the rear bearing, after which, the assembly can be lifted out of the case by its front end. (19)—Pull the reverse idler shaft out through the rear and lift out the gear.

SHIFTER MECHANISM: If necessary to disassemble, remove the shift fork lock screws and push the rails out through the front, holding a hand over the lock ball holes to prevent the balls and springs from flying out. CAUTION—As each rail is removed, it should be tagged to assure correct assembly. When assembling the cover, lubricate the lock balls and springs, and be sure the lock screws engage the holes in the rails before wiring them in place. Care must be exercised to see that all the interlock plunger parts are assembled correctly.

ASSEMBLE

(1)—Assemble the reverse idler gear and push the idler shaft in through the rear. (2)—Install the front countershaft bearing, place the countershaft assembly in the case and replace the rear countershaft bearing, using a new snap ring in the bearing groove, after which, replace the nut on the front end of the shaft and the lock bolt and washer at the rear. (3)—Assemble the main drive gear and insert it through the inside of the case, using a new snap ring in the bearing groove. (4)—Replace the drive gear retainer cover and bell housing. (5)—Lubricate the mainshaft front pilot bearing and place it in the drive gear pocket. (6)—Pass the mainshaft through the rear of the case, slipping on successively, the sliding gears, fourth speed gear and thrust washer. NOTE—Before installing the sliding clutch gear, engage the end of the T-shaped washer in the fourth speed gear thrust washer and push the T-shaped washer into its groove in the shaft. (7)—Slip the sliding clutch gear on the mainshaft, push the mainshaft all the way into position and replace the mainshaft rear bearings in the recess of the housing. (8)—Assemble the auxiliary countershaft gears and bearings in the housing and attach this housing to the main case. (9)—Place the auxiliary drive gear on the

end of the mainshaft and fasten the retaining nut securely. (10)—Lubricate the auxiliary pilot bearing and install it in the drive gear pocket. (11)—Pass the auxiliary mainshaft through the rear of its case, assembling the gears on the shaft while doing so. (12)—Install the auxiliary shaft rear bearing, using a new snap ring in the bearing groove. (13)—Replace the washer, speedometer drive gear and the rear bearing cover. (14)—Push in the universal flange, lock the mainshaft and run the flange nut up tight. (15)—Install the speedometer driven gear and the transmission cover assembly.

GROUP No. 60

Fig. 122

BROWN-LIPE TWO-SPEED AUXILIARY TRANSMISSION

Models 2321, 2323

DISASSEMBLE

(1)—Unscrew the front and rear companion flange nuts and pull off both flanges. (2)—Remove the speedometer driven gear and disconnect both bearing retainers. (3)—Unfasten the transmission cover and lift it off. (4)—The main drive gear and mainshaft assembly can then be lifted out as a unit. (5)—Remove the countershaft lock, drive the shaft out rearward and lift out the countergears and bearings. (6)—Separate the mainshaft from the drive gear and slip the gears from the shaft. (7)—If necessary, the bearing may be removed from the front retainer after releasing its snap ring.

NOTE—Assemble in the reverse order, using new snap rings in the bearing grooves.

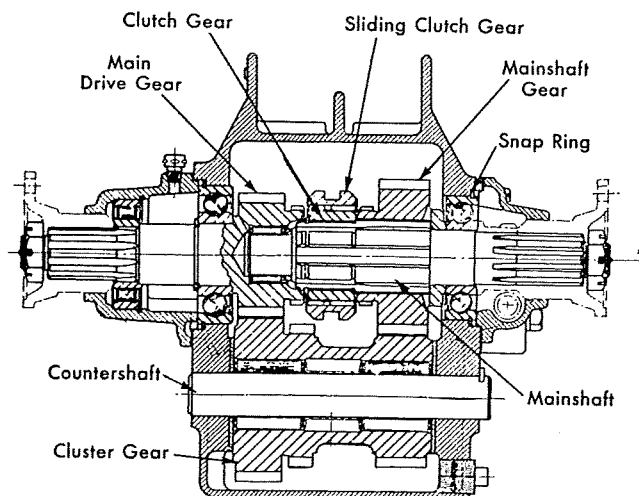


Fig. 122—Group No. 60 Brown-Lipe 2321, 2323

GROUP No. 61

Fig. 123

BROWN-LIPE TWO-SPEED AUXILIARY TRANSMISSION

Models 3221, 3222, 5222

DISASSEMBLE

(1)—Remove the transmission cover. (2)—Unscrew the nuts from the front and rear companion flanges and pull off the flanges. (3)—Remove the speedometer driven gear and the rear bearing retainer. (4)—Pull the mainshaft to the rear far enough to permit the speedometer drive gear and rear bearing to be removed. (5)—Grasp the mainshaft gears, pull the shaft all the way out through the rear and lift the gears out through the top. (6)—Remove the main drive gear bearing retainer, unscrew the drive gear retaining nut, push the gear into the case and lift it out from the inside. (7)—The drive gear bearing may then be removed by tapping it out through the front. (8)—Take off the countershaft rear bearing cover, unscrew the lock bolt, force the gear assembly to the rear until the bearing is clear of the case and lift the gear out through the top by its front end.

NOTE—Assemble in the reverse order, using new snap rings in the bearing grooves.

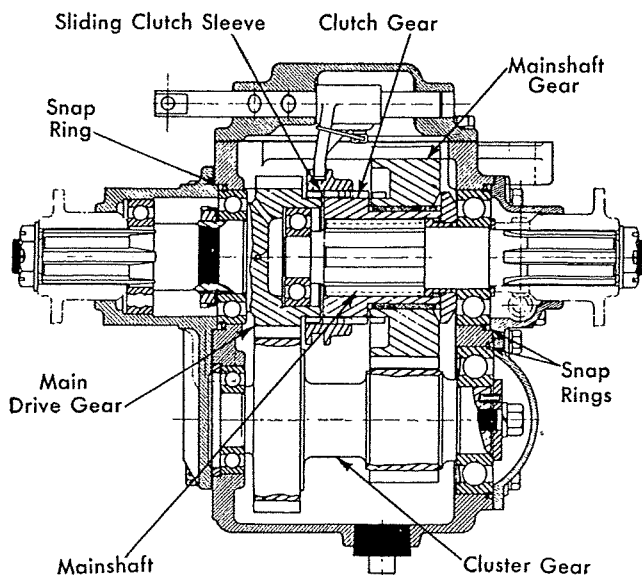


Fig. 123—Group No. 61—Brown-Lipe 3221, 3222

GROUP No. 62

Fig. 124

REO FOUR-SPEED SLIDING GEAR

DISASSEMBLE

NOTE—Also read note Group No. 63, page 113.

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the mainshaft in two gears and

unscrew the universal flange nut. (3)—Pull off the universal flange and speedometer drive gear. (4)—Disconnect the mainshaft rear bearing retainer, pull the mainshaft and rear bearing out through the rear and lift the gears out through the top. (5)—Remove the main drive gear bearing retainer and pull the drive gear assembly out through the front. NOTE—The drive gear and its bearing may be separated after unscrewing the retaining nut. (6)—Remove the countershaft rear bearing retainer, being sure to collect the bearing adjusting shims so the original thickness can be noted. (7)—Force the countershaft to the rear until the rear bearing is clear of the case and lift the gear out through the top by its front end. (8)—Pull the reverse idler gear shaft out rearward and lift out the gear.

SHIFTER MECHANISM: If necessary to disassemble the cover, remove the shift fork lock screws and drive the rails out, holding a hand over the lock ball holes to prevent the balls and springs from flying out. **CAUTION**—As each rail is removed, it should be tagged to assure correct assembly.

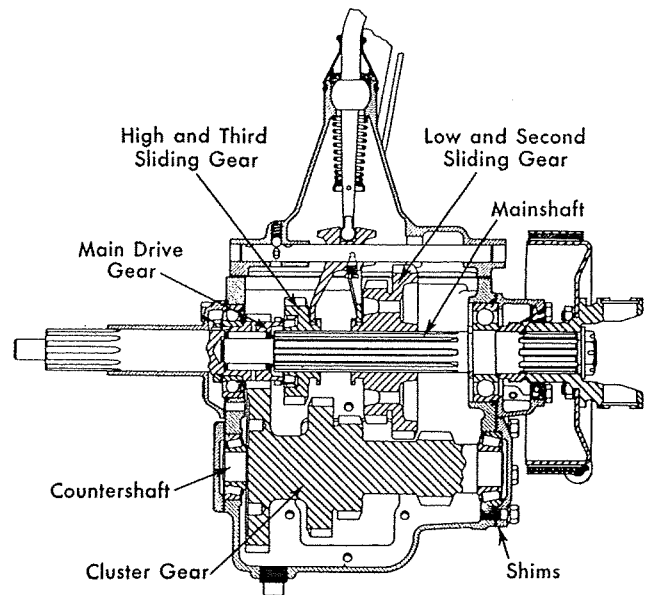


Fig. 124—Group No. 62 Transmission

When assembling, lubricate the balls and springs before replacing, and see that the lock screws engage the holes in the shift rails before wiring them in place. Be sure the interlock plungers are correctly assembled.

ASSEMBLE

(1)—Assemble the reverse idler gear and push the shaft in through the rear. (2)—Install the front countershaft bearing, place the countergear in the case and replace the rear bearing. NOTE—Assemble the original quantity of shims and fasten the countershaft rear bearing retainer firmly in place. When properly

TRANSMISSION, OVERHAUL

adjusted, there should be a slight drag when the shaft is turned by hand. If the shaft turns too easily or if end play is evident, shims of various thicknesses are available to obtain the correct adjustment. (3)—Assemble the main drive gear and install it through the front of the case, using a new snap ring in the bearing groove. (4)—Replace the drive gear bearing retainer. (5)—Lubricate the mainshaft pilot bearing and insert it in the drive gear pocket. (6)—Pass the mainshaft in through the rear of the case, assembling the gears on the shaft while doing so. (7)—Install the mainshaft rear bearing, using a new snap ring. (8)—Fasten the rear bearing retainer to the case, being sure the oil seal is in good condition. (9)—Assemble the speedometer drive gear and universal flange, lock the transmission in two gears and fasten the flange nut securely. (10)—Replace the speedometer driven gear and the transmission cover assembly.

GROUP No. 63

Fig. 125

REO FOUR-SPEED SLIDING GEAR

NOTE—This unit differs from the transmission described in Group No. 62 in that the mainshaft in this unit is mounted on tapered roller bearings at the rear and end play is controlled by shims. Although the countershaft bearings are of the tapered roller design, the unit differs from Group No. 62 in that the fourth and third speed gears may be replaced.

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Lock the mainshaft and unscrew the universal flange nut. (3)—Pull out the universal flange, the spacer and speedometer drive gear. (4)—Disconnect the mainshaft rear bearing retainer, being sure to collect the adjusting shims. (5)—Pull the mainshaft and rear bearings out through the rear and lift the gears out through the top. (6)—Disconnect the countershaft rear bearing retainer and remove the retainer and shims. (7)—Force the countershaft to the rear until the fourth speed gear is out of mesh with the main drive gear. (8)—Disconnect the drive gear bearing retainer and pull the main drive gear assembly out through the front. (9)—Remove the countershaft rear bearing and lift the countergear out through the top by its front end. NOTE—The fourth and third speed gears may be removed by pressing them from the shaft one at a time, and when installed, be sure keys are a tight fit. (10)—Pull the reverse idler shaft out and lift out the gear.

SHIFTER MECHANISM: If necessary to disassemble the cover, remove the shift fork lock screws and drive out the rails, holding a hand over the lock ball holes to prevent the balls and springs from flying out.

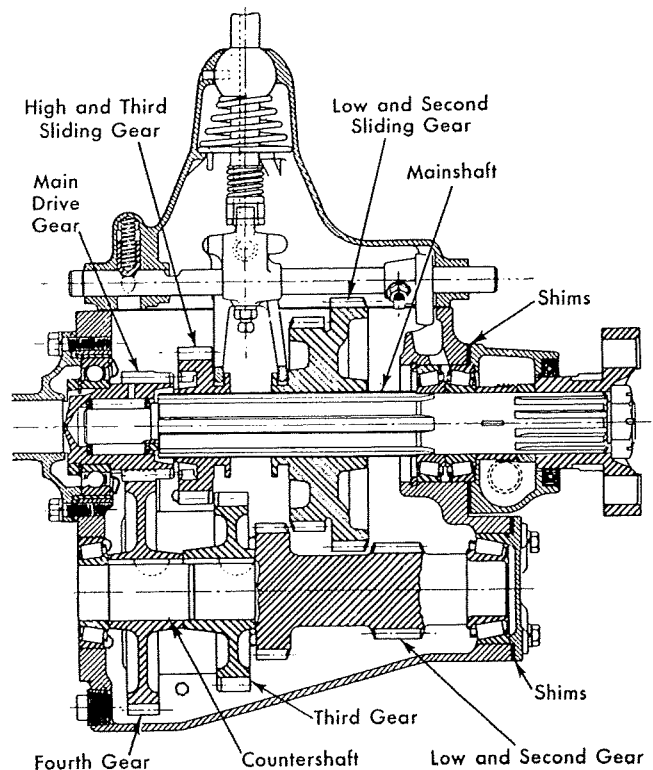


Fig. 125—Group No. 63 Transmission

CAUTION—As each rail is removed, it should be tagged to assure correct assembly.

When assembling, lubricate the balls and springs before replacing, and see that the lock screws engage the holes in the shift rails. Care should be exercised to see that the interlock plungers are correctly installed.

ASSEMBLE

(1)—Assemble the reverse idler gear and push in the shaft. (2)—Place the countergear assembly in the case, but do not assemble until after the main drive gear is in position. (3)—Assemble the main drive gear through the front and fasten the retainer securely to the case. (4)—Line up the countergear assembly and replace the rear bearing. (5)—Assemble the laminated shims and rear bearing cover to the case. NOTE—When properly adjusted, the countergear should have from zero clearance to .002" preload, or, in other words, there should be a slight drag when the shaft is turned by hand. If end play is evident or if the shaft turns too freely, peel off sufficient shims to obtain the desired adjustment. (6)—Pass the mainshaft through the rear of the case, slipping the mainshaft gears on the shaft while doing so. (7)—Replace the mainshaft rear bearings and assemble the shims and rear bearing retainer. NOTE—With the retainer securely fastened to the case, there should be no evidence of end play. When adjusted properly, there should be a slight drag

when the mainshaft is turned by hand. Remove or replace shims as required to obtain this result. (8)—Install the spacer, speedometer drive gear, push the universal flange in position, lock the mainshaft and run the flange nut up tight. (9)—Assemble the transmission cover assembly.

GROUP No. 64

Fig. 126

AUTOCAR FIVE-SPEED CONSTANT MESH

Models DF, UDF

DISASSEMBLE

(1)—Take off the shift lever and housing assembly and the bell housing. (2)—Remove the transmission top cover on model UDF and the side cover from the DF model. (3)—Loosen the shift fork lock screws and pull out the shift rails, holding a hand over the lock ball holes to prevent the balls and springs from flying out. **CAUTION**—As each rail is removed, it should be tagged to assure correct assembly; lift out the loose forks and tag them also. (4)—On the DF model, reach into the transmission side cover hole, loosen the fork lock screws and pull out the overdrive and reverse shift rails, after which, take out the forks.

(5)—On both units, continue in the following manner: remove the speedometer driven gear. (6)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (7)—Pull off the universal flange and speedometer drive gear. (8)—Remove the mainshaft rear bearing cover, the main drive gear cover and the front and rear countershaft covers. **CAUTION**—Be sure to collect the shims from the rear of the mainshaft and countershaft. (9)—Unscrew the nut from the rear of the mainshaft and remove the bearings and sleeve. (10)—Pull the main drive gear, its bearing and sleeve out through the front. **NOTE**—The bearing and drive gear can be separated after removing the bearing lock nut. (11)—Lift the mainshaft assembly out by its front end through the top. (12)—Unscrew the nut from the front end of the countershaft, push the shaft to the rear, remove the rear bearing and lift the assembly out of the case by its front end. (13)—Pull the reverse gear shaft out of the case and lift out the gear assembly.

MAINSHAFT: (a)—To disassemble, pull the sliding gears from the shaft. (b)—Remove the lock pin which retains the third and fourth speed sliding clutch gear to the mainshaft, then pull off the clutch gear and third speed gear assembly. (c)—Rotate the splined washer to align its teeth with the mainshaft splines and slip it from the shaft. (d)—Straighten the tab on the washer which holds the mainshaft

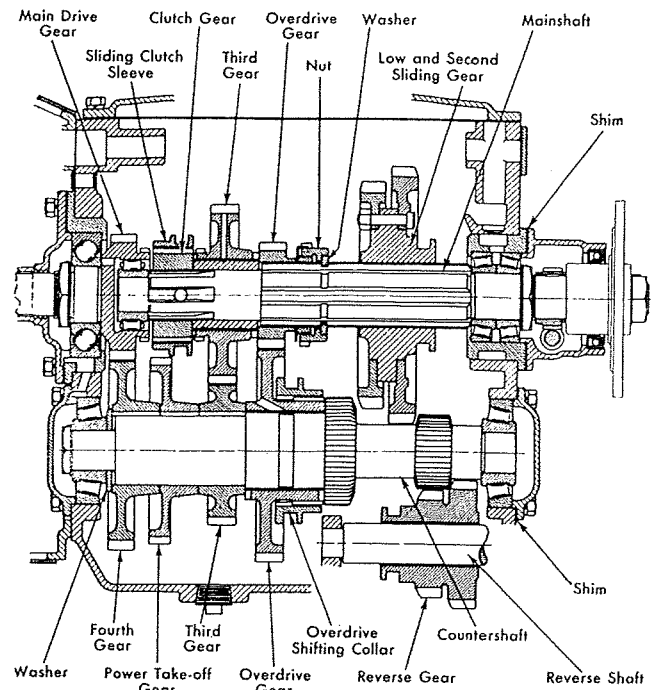


Fig. 126—Group No. 64 Autocar UDF

overdrive gear retaining nut in place and unscrew the nut from the overdrive gear; the gear, washer and nut can then be removed from the shaft.

COUNTERSHAFT: To disassemble, press the fourth speed gear, power take-off gear and third speed gear from the shaft one at a time, after which, the overdrive gear and shifting collar may be removed. **NOTE**—When installing the gears, be sure the keys are a tight fit, and see that the oil groove for the overdrive gear is open.

ASSEMBLE

(1)—Assemble the reverse gear in the case and push in the shaft. (2)—Install the countershaft front bearing, place the countershaft assembly in the case and replace the rear bearing. **NOTE**—Be sure the washer is placed on the front of the shaft before inserting shaft through the front bearing. (3)—Fasten the nut securely on the front end of the countershaft and replace the cover. (4)—Assemble the shims and bearing retainer cover at the rear end of the countershaft. **NOTE**—Remove shims as required to eliminate end play. (5)—Install the main drive gear assembly through the front of the case. (6)—Assemble the mainshaft gears in the reverse order of removal and place the assembly in position, then install the rear bearings and retainer. (7)—Fasten the nut securely to the end of the mainshaft, assemble the bearing adjusting shims and bolt the bearing retainer cover securely in place. **NOTE**—Eliminate

TRANSMISSION, OVERHAUL

end play in the mainshaft by removing shims as required. (8)—Install the speedometer drive gear and universal flange, lock the mainshaft and run the flange nut up tight. (9)—Install the shift rails and forks in the reverse order of removal, lubricating the lock balls and springs before replacing; be sure the lock screws engage the holes in the shift rails before wiring them in place. (10)—Replace the transmission cover, the shift lever housing assembly and the bell housing. (11)—Adjust the set screws at the shift rail ends to prevent the rails from over-shifting.

GROUP No. 65

Fig. 127

AUTOCAR FIVE-SPEED SLIDING GEAR

Models RL, URL

DISASSEMBLE

(1)—Take off the shift lever and housing assembly and the bell housing. (2)—Loosen the shift fork lock screws and pull out the shift rails, holding a hand over the lock ball holes to prevent the balls and springs from flying out. CAUTION—As each rail is removed, it should be tagged to assure correct assembly; lift out the loose shift forks and tag them also. (3)—Remove the speedometer driven gear. (4)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (5)—Pull off the universal flange, remove the rear bearing retainer, oil seal and the speedometer drive gear. (6)—Remove the main drive gear bearing, cover and the front and rear countershaft bearing covers. (7)—Pull the main drive gear and bearing assembly out through the front. NOTE—If required, the gear and bearing may be separated after removing the bearing lock nut. (8)—Grasp the mainshaft gears and pull the mainshaft through the gears and out through the rear of the case. (9)—Unscrew the nut from the front end of the countershaft, push the shaft to the rear, remove the rear bearing and lift the countershaft assembly out of the case by its front end. (10)—Remove the reverse gear shift rail and take out the fork. (11)—Pull the reverse gear shaft out rearward and lift out the gear.

ASSEMBLE

(1)—Assemble the reverse gear and push in the shaft. (2)—Install the reverse shift rail and fork. (3)—If required, the countershaft helical gears may be removed by pressing them off one at a time, and when installed, be sure the keys are a tight fit. (4)—Place the washer over the front end of the coun-

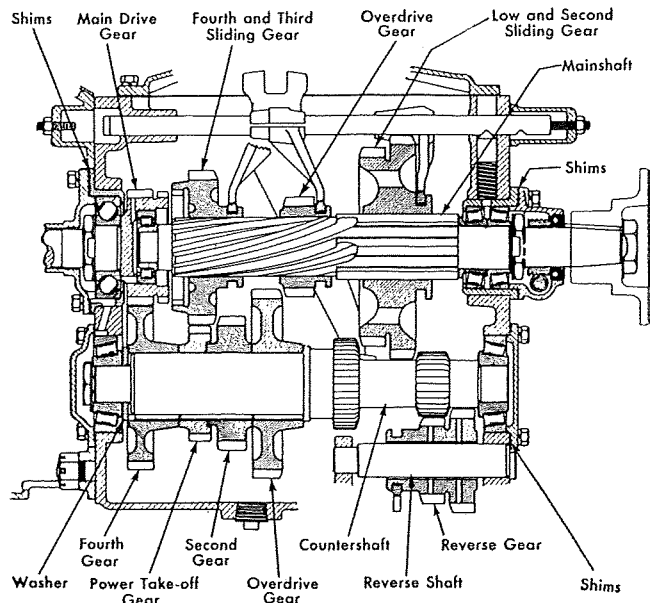


Fig. 127—Group No. 65 Autocar URL

tershaft, assemble the front bearing in position, place the countershaft assembly in the case and install the rear bearing. (5)—Run the nut up tight on the front end of the countershaft and replace the front bearing cover. (6)—Assemble the countershaft rear bearing cover and shims and check the end play, removing the required thickness of shims to eliminate any end play. (7)—Install the main drive gear assembly through the front and replace the retainer cover. (8)—Install the mainshaft rear bearings and sleeve on the shaft, pass the shaft through the rear of the case, assembling the sliding gears on the shaft as the shaft is being inserted. (9)—Install the lock nut on the end of the mainshaft and replace the speedometer drive gear. (10)—Assemble the shims and rear bearing retainer securely to the case and check for end play in the bearings; if end play exists, remove the required thickness of shims. (11)—Examine the rear oil seal and replace if necessary. (12)—Install the universal flange, lock the mainshaft and run the flange nut up tight. (13)—Replace the shift rails and forks in the reverse order of removal, lubricating the balls and springs before replacing; see that the lock screws engage the holes in the shift rails before wiring them in place. (14)—Install the bell housing and shift lever housing assembly. (15)—If required, adjust the set screws at the shift rail ends to prevent the rails from overshifting.

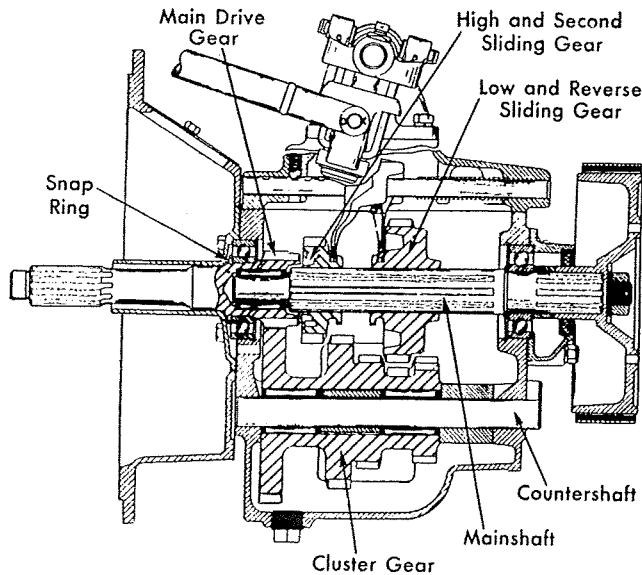


Fig. 128—Group No. 66 Transmission

GROUP No. 66

Fig. 128

WHITE THREE-SPEED SLIDING GEAR

Model 60B

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Remove the shift fork lock screws and pull the shift rails out through the front, holding a hand over the lock ball holes to prevent the balls and springs from flying out. (3)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (4)—Pull off the universal flange and brake drum. (5)—Remove the mainshaft rear bearing retainer and oil seal. (6)—Grasp the sliding gears and withdraw the mainshaft and rear bearing out rearward, then lift the gears out through the top. (7)—Take the mainshaft front pilot bearing out of the drive gear pocket, remove the drive gear bearing retainer, release the small snap ring and push the drive gear into the case and lift it out; the drive gear bearing may then be pushed out through the front. (8)—Unlock the countershaft and reverse idler shaft, tap the shafts out rearward and lift out the gears.

ASSEMBLE

(1)—Assemble the reverse idler gear and push the shaft in through the rear. (2)—Install the bearing spacer and roller bearings in the countergear, using grease to hold them in position, then drive the countershaft in through the rear. (3)—Install new snap rings in the drive gear and rear mainshaft bearing bores. (4)—Insert the main drive gear bearing in its

bore and replace the drive gear through the inside of the case. (5)—Lock the drive gear in position by installing a new snap ring in the groove in front of the bearing. (6)—Fasten the drive gear bearing retainer securely to the case. (7)—Lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (8)—Insert the mainshaft through the rear of the case, passing the sliding gears on the shaft at the same time. (9)—Install the mainshaft rear bearing and speedometer drive gear. (10)—Replace the rear bearing retainer oil seal if necessary, then fasten the retainer securely to the transmission. (11)—Install the universal flange and brake drum assembly, lock the mainshaft and run the flange nut up tight. (12)—If the transmission cover has been disassembled, assemble in the reverse order, lubricating the balls and springs before replacing; see that the shift fork lock screws engage the holes in the shift rails before wiring them in place. (13)—Install the transmission cover assembly.

GROUP No. 67

Fig. 129

WHITE FOUR-SPEED SLIDING GEAR

Models 4B, 26B

DISASSEMBLE

(1)—Take off the transmission cover and shifter assembly. (2)—Remove the pins from the shift forks, take out the screws and allow the balls and springs to drop out. (3)—Unscrew the nuts from the rear end of the rails and pull the rails out forward. (4)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (5)—Pull off the flange, remove the speedometer driven gear, disconnect the rear bearing retainer from the case and take off the speedometer drive gear. (6)—Grasp the mainshaft sliding gears and withdraw the shaft, together with the rear bearing and bearing sleeve through the rear of the case. (7)—Remove the main drive gear companion flange, disconnect the drive gear bearing from the case and pull the drive gear, together with its bearing and sleeve out through the front. (8)—Remove the front and rear countershaft bearing retainer caps, unscrew the nuts from the ends of the countershaft, push the shaft to the rear until the rear bearing and sleeve can be removed and lift the countershaft assembly out of the case by its front end. (9)—Unscrew the bolts which retain the reverse gear shaft, pull out the shaft and lift out the gear.

ASSEMBLE

(1)—Assemble the reverse gear with the large gear to the rear and push in the shaft, fastening it securely in place with the cap screws. (2)—Install the countershaft front bearing and sleeve in the case and place

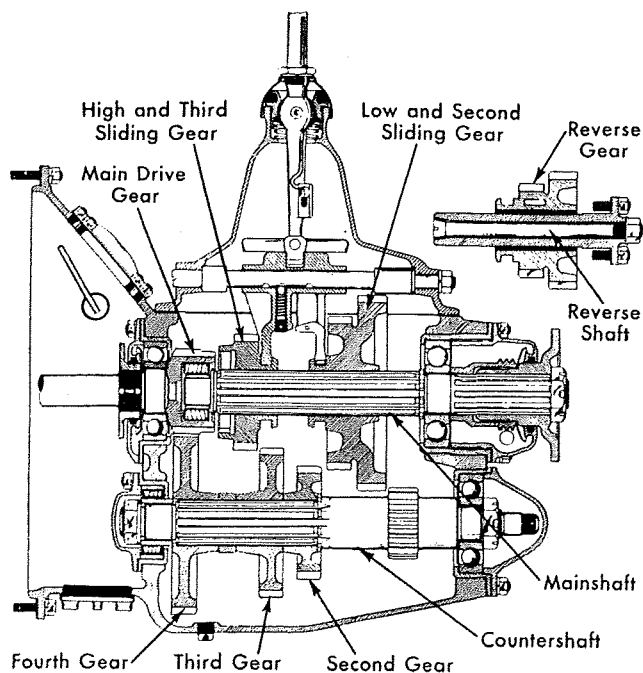


Fig. 129—Group No. 67 White 4B

the countershaft assembly in position, after which, the rear bearing and sleeve may then be assembled. (3)—Install the front and rear nuts to the countershaft, locking them securely in place, then replace the bearing retainers. (4)—Assemble the main drive gear, being sure the oil seal is in good condition and install the assembly through the front of the case. (5)—Lubricate the mainshaft front pilot bearing and place it in the drive gear pocket. (6)—Pass the mainshaft through the rear of the case, installing the sliding gears on the shaft as it is being inserted. (7)—Replace the mainshaft rear bearing and sleeve, slip the speedometer drive gear on the shaft and fasten the rear bearing retainer securely in place, being sure the oil seal is in good condition. (8)—Install the universal flange, lock the mainshaft and run the flange nut up tight. (9)—Assemble the transmission cover in the reverse order of removal and install the cover to the transmission.

GROUP No. 68

Fig. 130

WHITE HORSE THREE-SPEED SILENT MESH

Model 64BA

DISASSEMBLE

(1)—With the transmission and rear axle removed from the chassis, unfasten the bolts which hold the transmission housing to the differential carrier.

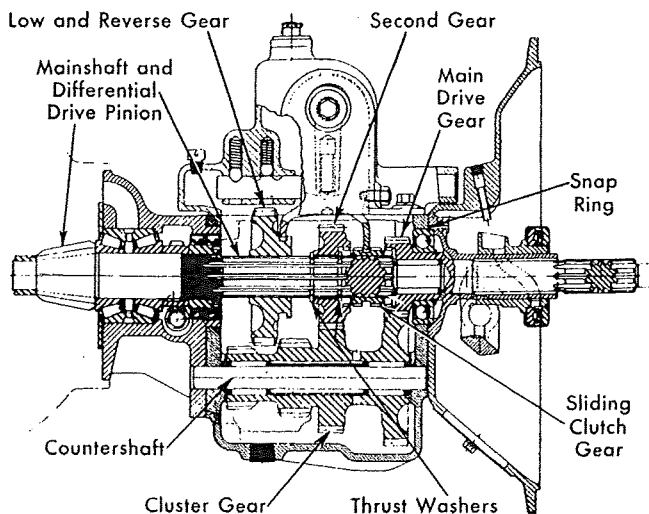


Fig. 130—Group No. 68 Transmission

CAUTION—Be sure to collect the shims separating these two housings as they control the adjustment of the differential drive pinion. (2)—Remove the transmission cover and shifter assembly. (3)—Take out the shift fork lock screws and pull the shift rails out through the front of the cover, holding a hand over the lock ball holes to prevent the balls and springs from flying out. (4)—Remove the clutch release mechanism, the bell housing and the main drive gear bearing retainer. (5)—Pull the main drive gear and bearing assembly out through the front and take out the mainshaft pilot bearing from the drive gear pocket. **NOTE**—The drive gear and bearing may be separated after removing the retaining snap ring. (6)—Slip the sliding clutch gear from the mainshaft and pull it out through the front. (7)—Rotate the second speed gear front thrust washer so that its teeth align with the splineways of the mainshaft and slide the washer and gear forward; do likewise with the second gear rear thrust washer. (8)—Remove the speedometer driven gear. (9)—Disconnect the rear bearing retainer housing from the transmission case and withdraw the mainshaft, together with the retainer and bearings through the rear, lifting the gears and washers from the mainshaft as it is being withdrawn. **NOTE**—The mainshaft rear bearing, speedometer drive gear and differential drive pinion bearings may now be removed from the mainshaft. (10)—Drive the countershaft and idler gear shaft from the case and lift out the gears.

ASSEMBLE

(1)—Assemble the reverse gear and push in the shaft. (2)—Assemble the bearing spacer and bearings in the countershaft and install the shaft. (3)—Install the mainshaft rear bearing, speedometer drive

gear and differential drive pinion bearings in the reverse order of their removal. (4)—Insert the mainshaft through the rear of the case, passing it through the mainshaft gears and washers; lock the second speed gear in position by rotating the washers so that their teeth engage the splines of the mainshaft. (5)—Slip the sliding clutch gear in position on the shaft. (6)—Lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (7)—Assemble the drive gear and bearing, using new snap rings and install through the front. (8)—Fasten the drive gear retainer to the case, install the bell housing and clutch release mechanism. (9)—Assemble the transmission cover in the reverse order of removal, being sure to lubricate the lock balls and springs before replacing, then install the cover to the transmission. NOTE—The transmission assembly is now ready to be attached to the differential, but if repairs are to be made to the carrier assembly, see the DIFFERENTIAL, OVERHAUL chapter.

GROUP No. 69

Fig. 131

MACK FIVE-SPEED CONSTANT MESH

Models TR-30, TR-31

DISASSEMBLE

(1)—Take off the transmission cover plate and shift lever. (2)—Remove the shift fork lock screws and push the rails out forward, holding a hand over the lock ball holes to prevent the balls and springs from flying out. CAUTION—As each rail is removed, it should be tagged to assure correct assembly. (3)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the universal flange nut. (4)—Pull off the universal flange, remove the clutch release mechanism and the main drive gear bearing retainer. (5)—Pull the drive gear assembly out forward. NOTE—To separate the gear and bearing, remove the bearing retainer nut. (6)—Disconnect the mainshaft rear bearing retainer and pull the mainshaft to the rear far enough to permit the removal of the rear bearing. (7)—Tilt the front end of the mainshaft upward and lift the assembly out through the top. (8)—Disassemble the mainshaft by taking the sliding gears and sliding clutch gear from the shaft, then remove the fourth speed gear sleeve and washers (fifth gear on overdrive units), after which, the third speed gear may be removed. (9)—Remove the countershaft front and rear bearing retainers. CAUTION—Be sure to collect the shims which are used to control the end play of the bearings. (10)—Push the countershaft to the rear until the rear bearing is clear of the case, then lift the

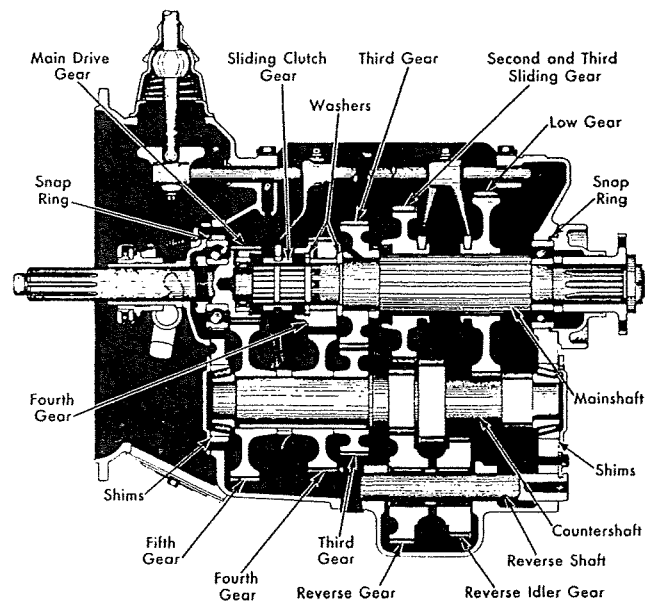


Fig. 131—Group No. 69 Mack TR-31

assembly out by its front end. NOTE—The countershaft helical gears may be removed by pressing them off one at a time, and when installed, be sure the keys are a tight fit. (11)—Unscrew the reverse gear shaft lock bolt, remove the lock and pull the shaft out rearward, then lift out the gear.

ASSEMBLE

(1)—Assemble the reverse gear and bearings with the smaller gear to the rear and push the shaft in place, locking the shaft by means of the lock plate and screw. (2)—Install the countershaft assembly and replace the bearings. (3)—Assemble the shims and bearing retainers, removing shims as required to eliminate any end play, yet having the bearings free-rolling. (4)—Assemble the mainshaft in the reverse order of removal and install in the case. NOTE—If new bushings are required in the mainshaft third and fourth speed gears (fifth gear on overdrive units), it is necessary that they be sized and broached in place; if the necessary equipment is not available, there should be at least .004" clearance between the bushing and sleeve. (5)—Install the mainshaft rear bearing, using a new snap ring, then replace the rear bearing retainer. (6)—Lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (7)—Install the main drive gear assembly through the front, using a new snap ring to retain the bearing. (8)—Assemble the main drive gear bearing retainer and clutch release mechanism. (9)—Install the universal flange, lock the mainshaft and tighten the flange nut

TRANSMISSION, OVERHAUL

securely. (10)—Assemble the shift rails and forks in the reverse order of removal, lubricating the balls and springs before replacing; see that the lock screws engage the holes in the shift rails before wiring them in place.

GROUP No. 70

Fig. 132

PAK-AGE-CAR TRANSMISSION

Stutz Model

DISASSEMBLE

NOTE—See the DIFFERENTIAL, OVERHAUL chapter for repairs on this unit.

(1)—Take off the transmission top cover. (2)—Remove the shift fork lock screws and pull out the shift rails, being careful not to lose the poppet balls and springs. (3)—Remove the hand brake mechanism and pull off the differential drive pinion flange. (4)—Remove the reduction gear housing. (5)—Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the nut which retains the mainshaft reduction gear to the end of the mainshaft. (6)—Remove the speedometer drive gear and spacer. (7)—Pull the reduction gear from the mainshaft. (8)—Withdraw the mainshaft assembly through the rear of the case. (9)—Push the main drive gear into the transmission and lift it out through the top. NOTE—The drive gear bearing may then be removed after releasing the retaining snap ring. (10)—Remove the countershaft lock pin, drive the countershaft out of the case and lift out the gear and thrust washers. (11)—Remove the reverse idler shaft lock, drive out the shaft and lift out the gear.

MAINSHAFT: (a)—To disassemble, slip off the sliding gear. (b)—Mark the relationship of the synchronizer sleeve with the synchronizer clutch gear and also, its position on the mainshaft, so that the original assembly may be maintained. (c)—Slide the synchronizer unit from the mainshaft. (d)—Use a suitable pointed tool to depress the second speed gear thrust washer plunger. (e)—With the plunger depressed, rotate the front thrust washer so that its internal teeth align with the splineways on the mainshaft, after which, the second speed gear and thrust washers may be removed from the shaft. CAUTION—Care should be exercised to see that the plunger

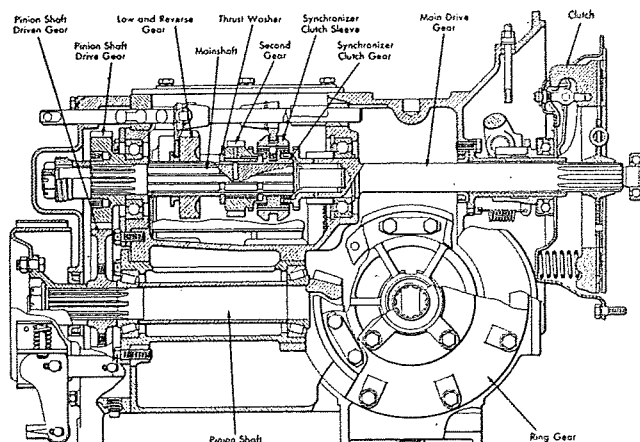


Fig. 132—Group No. 70 Transmission and Differential

does not stick in the oil hole as the gear is being removed. (f)—When the second speed gear is replaced, check its end play and, if excessive, use new thrust washers.

NOTE—To disassemble the synchronizer, wrap a cloth around the assembly to avoid losing the balls and springs and push the clutch gear from the sleeve. To assemble, apply a liberal quantity of grease to the holes in the clutch gear insert the balls and springs. Use a piston ring compressor type clamp to compress the assembly enough to enable the sleeve to be installed.

ASSEMBLE

(1)—Position the reverse idler gear in the case and install the shaft. (2)—Assemble the cluster gear and thrust washers in the case, using grease to hold the thrust washers in place, then drive in the shaft. (3)—Install the main drive gear through the inside of the case. (4)—Lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (5)—Insert the mainshaft through the rear of the case. (6)—Install the mainshaft reduction gear. (7)—Replace the speedometer drive gear spacer and drive gear. (8)—Lock the mainshaft and fasten the nut on the end of the mainshaft. (9)—Install the reduction gear housing, the differential drive pinion flange and hand brake mechanism. (10)—Assemble the shifter mechanism in the reverse order of removal, lubricating the poppet balls and springs, and see that the lock screws engage the holes in the rails before wiring them in place. (11)—Replace the transmission top cover.

GROUP No. 71

Fig. 133

PAK-AGE-CAR TRANSMISSION

Diamond T Model

DISASSEMBLE

NOTE—See the DIFFERENTIAL, OVERHAUL chapter for repairs on this unit.

(1)—Disconnect the shift lever from the shift rail and remove the transmission cover assembly. (2)—Loosen the shift fork lock screws and drive the rails out rearward, driving the expansion plugs out of the cover at the same time. (3)—Remove the reduction gear housing. (4)—Set the transmission in two gears to prevent the mainshaft from turning and unscrew the nut which retains the reduction gear on the mainshaft. (5)—Use a suitable puller to remove the mainshaft reduction gear. (6)—Withdraw the mainshaft assembly through the mainshaft bearing bore. (7)—Remove the main drive gear by pushing it into the transmission and lift it out through the top. (8)—The drive gear bearing is then removed after releasing the snap ring. (9)—To remove the countershaft, use a dummy shaft which is the same length as the cluster gear and thrust washers combined and drive the countershaft out, allowing the dummy shaft to remain in the cluster to hold the needle bearings in place. (10)—Drive out the reverse idler gear shaft and lift out the gear.

MAINSHAFT: (a)—To disassemble, slip the low speed gear and synchronizer assembly from the shaft. (b)—Remove the second speed gear thrust washer and take off the gear. (c)—Mark the relationship of the synchronizer clutch sleeve with the clutch gear so that assembly may be made in the original position, then push the gear out of the sleeve. NOTE—When assembled, be sure the synchronizer friction spring engages the notches in the center of the clutch sleeve teeth. When installed on the mainshaft, the straight portion of the synchronizer sleeve should face the second speed gear.

ASSEMBLE

(1)—Install the reverse idler gear and shaft. (2)—If the cluster gear has been disassembled, insert the dummy shaft and pack the ends of the cluster gear with grease to hold the needle bearings in place when they are installed. (3)—Assemble the thrust washers, using grease to hold them in place also, then place the assem-

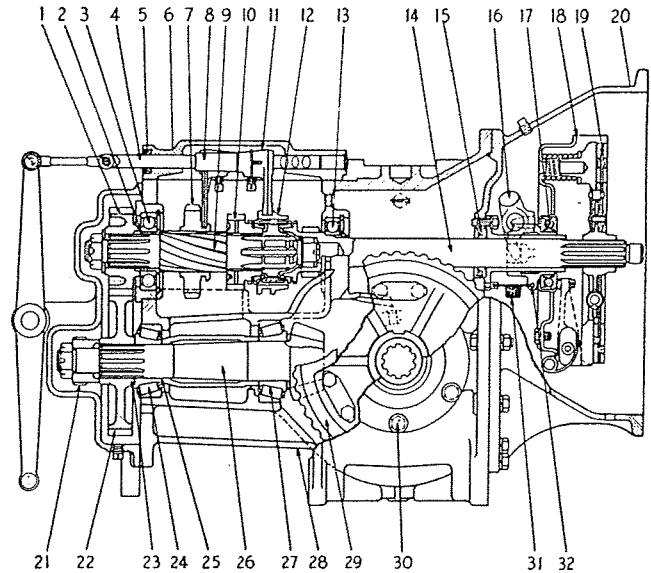


Fig. 133—Group No. 71 Transmission and Differential.

- | | |
|-----------------------------|----------------------------------|
| 1—Pinion shaft drive gear | 17—Release bearing |
| 2—Shim | 18—Clutch |
| 3—Transmission M.S. bearing | 19—Clutch driven disc |
| 4—Shift rail | 20—Clutch housing |
| 5—Shift rail seal | 21—Speedometer drive gear |
| 6—Transmission cover | 22—Pinion shaft driven gear |
| 7—1st and reverse gear M.S. | 23—Shim |
| 8—Shift fork | 24—Pinion shaft bearing |
| 9—Main shaft | 25—Shim |
| 10—2nd speed gear M.S. | 26—Pinion shaft |
| 11—Shift fork | 27—Pinion shaft bearing |
| 12—Synchroizer assembly | 28—Housing |
| 13—Main drive gear bearing | 29—Ring gear |
| 14—Main drive gear | 30—Ring gear screw |
| 15—Main drive gear oil seal | 31—Clutch release bearing spring |
| 16—Clutch throwout yoke | 32—Release bearing carrier |

bly in the case, driving the dummy shaft out with the regular countershaft. (4)—Install the main drive gear bearing, using a new snap ring. (5)—Insert the drive gear through the inside of the transmission. (6)—Lubricate the mainshaft pilot bearing and place it in the drive gear pocket. (7)—Insert the mainshaft through the mainshaft bearing bore, being sure to use a new snap ring in back of the mainshaft bearing. (8)—Install the mainshaft reduction gear, lock the mainshaft and fasten the nut securely. (9)—Replace the reduction gear housing. (10)—Assemble the shift rails and forks in the reverse order of removal, lubricating the balls and springs before replacing; see that the lock screws engage the holes in the rails before wiring them in place. NOTE—New expansion plugs should be used, and if the shift rail oil seal shows evidence of wear, install a new one. (11)—Replace the transmission cover and connect the shift lever to the shift rail.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

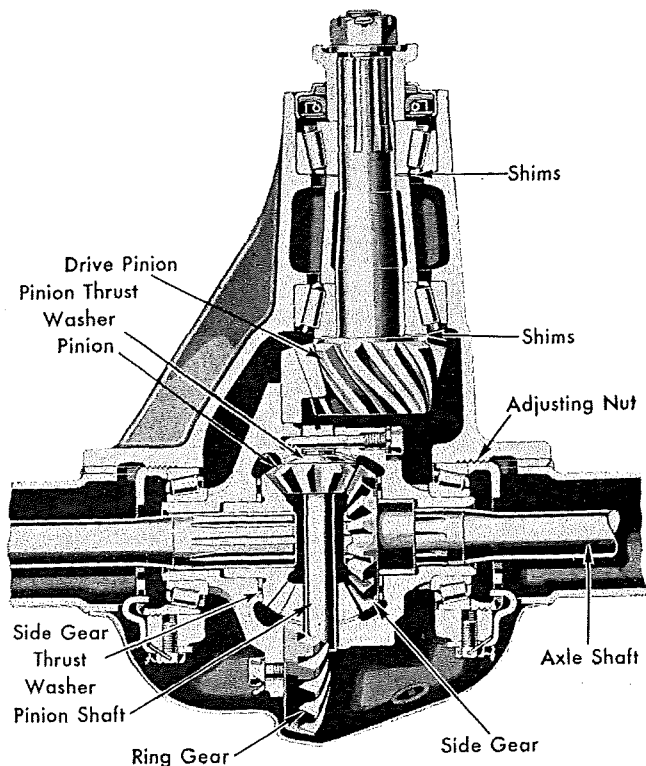


Fig. 134—Group No. 100 Rear Axle, Chrysler

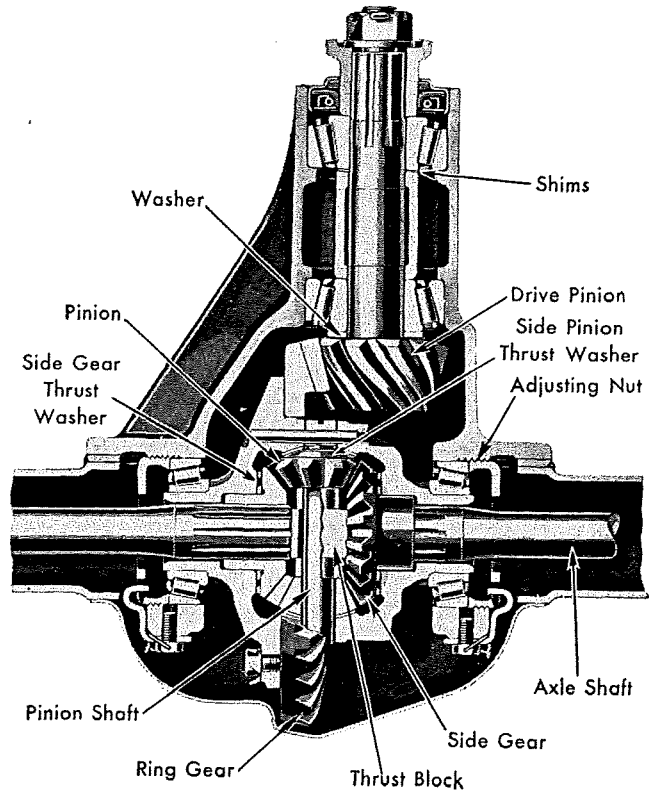


Fig. 135—Group No. 100 Rear Axle, Chrysler

GROUP No. 100

Figs. 134, 135, 136

CHRYSLER 1936-39 ALL; C25, C26 1940; C28 C30 1941; C34, C36 1942. DE SOTO 1936-42 ALL. DODGE PASSENGER CARS, 1936-42 ALL. DODGE TRUCKS, LC 1936; MC, MD 1937; RC, RD 1938; TC, TD 1939; VC, VD-15 1940; WC, WD-15 1941-42. NASH 3620, 3680; 1937-40 SERIES 80. PLYMOUTH 1936-42 ALL

DISASSEMBLE

(1)—Drain the oil from the differential by removing drain plug or two bottom cap screws which fasten the carrier to the rear axle housing. (2)—Remove the axle shafts as described in Group No. 124, page 162. (3)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (4)—Remove the cap screws which hold the differential carrier to the axle housing and lift out the differential carrier. (5)—Mount the carrier on a bench or fasten it in a vise. (6)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the

carrier so that they can be assembled with approximately the same drive gear adjustment. (7)—Remove the differential bearing cap screws and lift off the caps. (8)—With a puller, remove the differential bearings. (9)—Lift out the differential and ring gear assembly.

(10)—To disassemble the differential and ring gear assembly, remove the bolts, or cap screws if they are used, which hold the ring gear to the differential case. (11)—Press the ring gear off the differential case. (12)—Remove the differential pinion shaft lock pin, or lock screw if it is used, and push out the differential pinion shaft. (13)—All differential parts will then be loose and can be removed by hand.

NOTE—The differential assembly must be removed before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

(14)—Remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (15)—With a suitable tool, pull off the universal joint drive flange. (16)—If it is just necessary to remove the oil seal, remove it from the pinion shaft with a puller.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

(17)—If the pinion is to be removed, pull it out through the rear end of the carrier case. (18)—The bearing spacer, front bearing and shims may then be removed from the housing. (19)—With a bearing puller, remove the gear bearing cone from the pinion shaft. Unless the ring gear and pinion are to be replaced with new parts, use care not to get the front bearing shims and the rear bearing shims mixed.

ASSEMBLE

(1)—If the differential assembly was satisfactory from a standpoint of noise, before the unit was disassembled, then the drive pinion may be assembled with the original shims or washer behind the rear bearing. If new parts were installed or an adjustment was necessary, change these shims until the correct thickness is obtained to locate the pinion properly with relation to the ring gear. Play in the pinion shaft bearings on 1936 cars should be .004" to .008" and from .0015" to .0025" tight, pre-loaded, on 1937 to 1942 cars. (2)—To obtain this play or pre-load, insert sufficient shims between the bearing spacer and the front bearing. If available, a dial indicator should be used to make this check. To make this adjustment, remove the drive pinion flange, oil seal, front bearing and then add or remove the required number of shims. (3)—Assemble the bearing, oil seal and flange, being sure to apply lubricant to the bearings before final assembly. (4)—Use a new cotter pin and lock washer when locking the flange in place.

(5)—To assemble the differential, press the differential bearings in place. (6)—Install the side gear thrust washers and side gears in the case. (7)—Mesh the differential pinions with side gears, holding the thrust washers on the back of the gears. (8)—Rotate the side gears until the holes through the center of the pinions are in line with the hole for the pinion shaft, in the case. (9)—Push, do not drive, the pinion shaft in place so that the hole in the shaft for the lock screw or pin registers with the hole in the case. (10)—Then install the lock screw or pin. (11)—Locate the differential case in the carrier. (12)—Install the differential bearing caps and adjusting nuts. (13)—Draw up on the adjusting nuts until the marks which you made on the bearing adjusting nuts and caps indicate that the bearings are in their original position. (14)—Then tighten the cap screws in the bearing caps until the lock washers just flatten out.

ADJUSTMENT

(a)—If new parts were installed or an adjustment was necessary, the differential bearing adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. (b)—Then back off the adjusting nuts to relieve strain and then

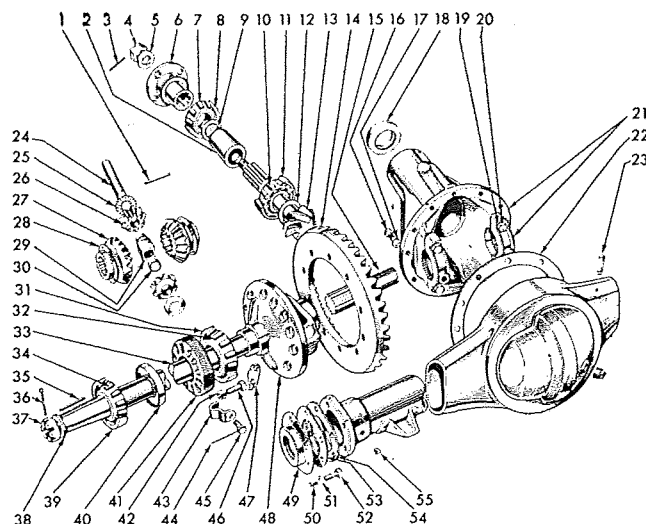


Fig. 136—Group No. 100 Rear Axle, Chrysler

- | | |
|-----------------------------------|----------------------------------|
| 1—Pinion shaft lock pin | 29—Thrust block |
| 2—Drive pinion bearing spacer | 30—Thrust block spacer |
| 3—Flange nut cotter pin | 31—Differential bearing cup |
| 4—Flange nut | 32—Differential bearing cone |
| 5—Flange nut washer | 33—Axle shaft |
| 6—Drive pinion flange | 34—Axle shaft bearing cone |
| 7—Drive pinion front bearing cone | 35—Axle shaft key |
| 8—Drive pinion front bearing cup | 36—Cotter pin |
| 9—Front bearing adjusting shims | 37—Nut |
| 10—Drive pinion rear bearing cone | 38—Washer |
| 11—Drive pinion rear bearing cup | 39—Axle shaft bearing cup |
| 12—Rear bearing washer | 40—Axle shaft oil washer |
| 13—Drive pinion | 41—Differential bearing adjuster |
| 14—Ring gear | 42—Ring gear nut |
| 15—Axle shaft | 43—Bearing adjuster lock |
| 16—Carrier screw | 44—Lock screw lock wire |
| 17—Lock washer | 45—Lock screw |
| 18—Drive pinion bearing oil seal | 46—Ring gear bolt |
| 19—Bearing cap screw lock washer | 47—Ring gear bolt lock |
| 20—Bearing cap screw | 48—Differential case |
| 21—Differential carrier and cap | 49—Axle shaft bearing oil seal |
| 22—Carrier gasket | 50—Brake support nut |
| 23—Housing vent nipple | 51—Brake support lock washer |
| 24—Differential pinion shaft | 52—Brake support bolt |
| 25—Thrust washer | 53—Oil seal retainer gasket |
| 26—Differential pinion | 54—Axle shaft bearing shim |
| 27—Differential side gear | 55—Bearing oil hole plug |
| 28—Side gear thrust washer | |

tighten them again slightly against the bearing cup. (c)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (d)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, until a locking position is reached.

(15)—Mount a dial indicator on the carrier and check the backlash between the ring gear and the pinion. On 1936 Chrysler, De Soto, Dodge and Plymouth cars it should be .006" to .010", on 1937 to 1940 cars it should be .006" to .010" and on 1941-42 cars it should be .006" to .010". On Nash cars it should be .005" to .007". (16)—If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. (17)—If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. (18)—Now tighten

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

the bearing cap lock screws securely and recheck the backlash. (19)—When correct, install the adjusting nut locks and lock the adjustment.

(20)—After this is correct, assemble the carrier in the rear axle housing. (21)—A new gasket and lock washers should be used whenever the carrier is removed from the housing. (22)—Pull up the cap screws evenly and securely. (23)—Assemble the axle shafts as described under AXLE SHAFT, REMOVE AND REPLACE chapter. (24)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (25)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

GROUP No. 101

Fig. 137

CHRYSLER C27 1940, C33 1941, C37 1942
DODGE TRUCKS VD-20, VD-21 1940; WD-20,
WD-21 1941-42

DISASSEMBLE

(1)—Drain the oil from the differential by removing two bottom cap screws which fasten the carrier to the rear axle housing. (2)—Remove the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (3)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (4)—Remove the cap screws which hold the differential carrier to the axle housing and lift out the differential carrier. (5)—Mount the carrier on a bench or fasten it in a vise. (6)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (7)—Remove the differential bearing cap screws and lift off the caps. (8)—Lift out the differential and ring gear assembly.

(9)—To disassemble the differential and ring gear assembly, remove the bolts, which hold the ring gear to the differential case. (10)—Press the ring gear off the differential case. (11)—Remove the differential case bearing on the cap side only with a suitable puller. (12)—Remove the differential case cap locking pin by driving it through the case. (13)—Place the differential case in a pan and fill the pan with water up to a level $\frac{1}{2}$ " below the cover. (14)—Remove the case and boil the water. (15)—Then submerge the case in the boiling water in order to heat the case without heating the cap. Do not heat the case with a flame. (16)—Remove the case from the water, attach it immediately to a fixture and remove the cap, using a spanner

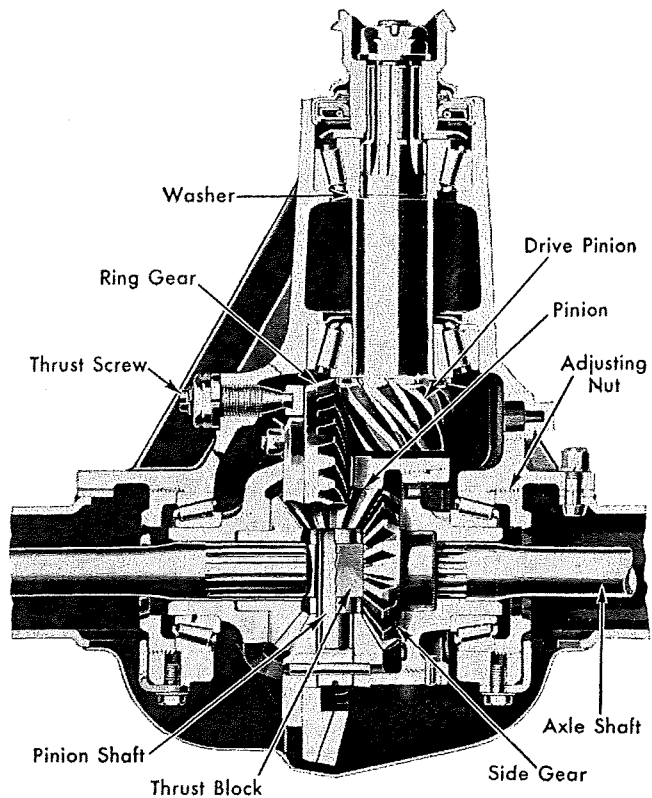


Fig. 137—Group No. 101 Rear Axle

wrench. (17)—While a helper applies pressure on the spanner wrench, jar the cover loose with a hammer and soft drift with a smart rap on the web of the cover. (18)—Remove the differential pinion shaft locking pin by driving it out of the case with a hammer and punch. (19)—Push the differential pinion shaft out of the differential case. (20)—The gears, thrust washers and axle shaft thrust block will then all be loose and fall out of the case.

NOTE—The differential assembly must be removed before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

(21)—Remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (22)—With a suitable tool, pull off the universal joint drive flange. (23)—If it is just necessary to remove the oil seal, remove it from the pinion shaft with a puller. (24)—If the pinion is to be removed, pull it out through the rear end of the carrier case. (25)—The bearing spacer, front bearing and shims may then be removed from the housing. (26)—With a bearing puller, remove the rear bearing cone from the pinion shaft. Unless the ring gear and pinion are to be

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

replaced with new parts, use care not to get the front bearing shims and the rear bearing shims mixed.

ASSEMBLE

(1)—If the differential assembly was satisfactory from a standpoint of noise, before the unit was disassembled, then the drive pinion may be assembled with the original shims or washer behind the rear bearing. If new parts were installed or an adjustment was necessary, change these shims until the correct thickness is obtained to locate the pinion properly with relation to the ring gear. The pinion shaft bearings are from .0015" to .0025" tight, pre-loaded. (2)—To obtain this pre-load, insert sufficient shims between the shoulder of the pinion bearing shaft and the front bearing. If available, a dial indicator should be used to make this check. To make this adjustment, remove the drive pinion flange, oil seal, front bearing and then add or remove the required number of shims. (3)—Assemble the bearing, oil seal, washer, oil slinger and flange, being sure to apply lubricant to the bearings before final assembly. The oil baffle in front of the rear pinion bearing should be assembled with its tab engaged in the lower notch of the carrier and the oil slinger in front of the front bearing should be installed between the flange and the washer with the beveled side toward the bearing. (4)—Use a new cotter pin and lock washer when locking the flange in place. (5)—To assemble the differential, coat the parts with rear axle lubricant to facilitate holding them in place until the thrust block and differential pinion shaft are installed. (6)—Install the side gear thrust washers and side gears in the case. (7)—Mesh the differential pinions with the side gears, holding the thrust washers on the back of the gears. (8)—Rotate the side gears until the holes through the center of the pinions are in line with the hole for the pinion shaft in the case. (9)—Push, do not drive, the pinion shaft in place so that the hole for the lock pin registers with the hole in the case. (10)—Then install the lock pin. (11)—Peen over the outside edge of the hole to lock the pin in place. (12)—Heat the case as outlined in the disassembly instructions and install the case cap. (13)—Tighten it rigidly in place with a spanner wrench. (14)—Drill a new hole through the cap and the case of a size corresponding to the small end of the case cap locking pin. (15)—Then install a new locking pin. (16)—Locate the differential case in the carrier. (17)—Install the differential bearing caps and adjusting nuts. (18)—Draw up on the adjusting nuts until the marks which you made on the bearing adjusting nuts and caps indicate that the bearings are in their original position. (19)—Then tighten the cap screws in the bearing caps until the lock washers just flatten out.

ADJUSTMENT

(a)—If new parts were installed or an adjustment was necessary, the differential bearing adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. (b)—Then back off the adjusting nuts to relieve strain and then

tighten them again slightly against the bearing cup. (c)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (d)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, until a locking position is reached.

(20)—Mount a dial indicator on the carrier and check the backlash between the ring gear and the pinion. It should be .006" to .010". (21)—If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. (22)—If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. (23)—Now tighten the bearing cap lock screws securely and recheck the backlash. (24)—When correct, install the adjusting nut locks and lock the adjustment. (25)—To adjust the drive gear thrust pad on the side of the differential carrier turn the screw in finger tight and then back it off $\frac{1}{8}$ turn. Lock this adjustment with the lock nut.

(26)—After this is correct, assemble the carrier in the rear axle housing. (27)—A new gasket and lock washers should be used whenever the carrier is removed from the housing. (28)—Pull up the cap screws evenly and securely. (29)—Assemble the axle shafts as described under AXLE SHAFT, REMOVE AND REPLACE Chapter. (30)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (31)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

GROUP No. 102

Fig. 138

HUDSON 1936-1942

DISASSEMBLE

(1)—Drain the oil from the differential by removing two bottom cap screws which fasten the carrier to the rear axle housing. (2)—Remove the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (3)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (4)—Remove the cap screws which hold the differential carrier to the axle housing and lift out the differential carrier. (5)—Mount the carrier on a bench or fasten it in a vise. (6)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (7)—Remove the cotter pins from the differential bearing adjusting nut locks and take out the locks. (8)—Remove the differential bearing cap screws and lift off the caps. (9)—With a puller, remove the differential bearings. (10)—Lift out the differential and ring gear assembly. (11)—Remove the differential

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

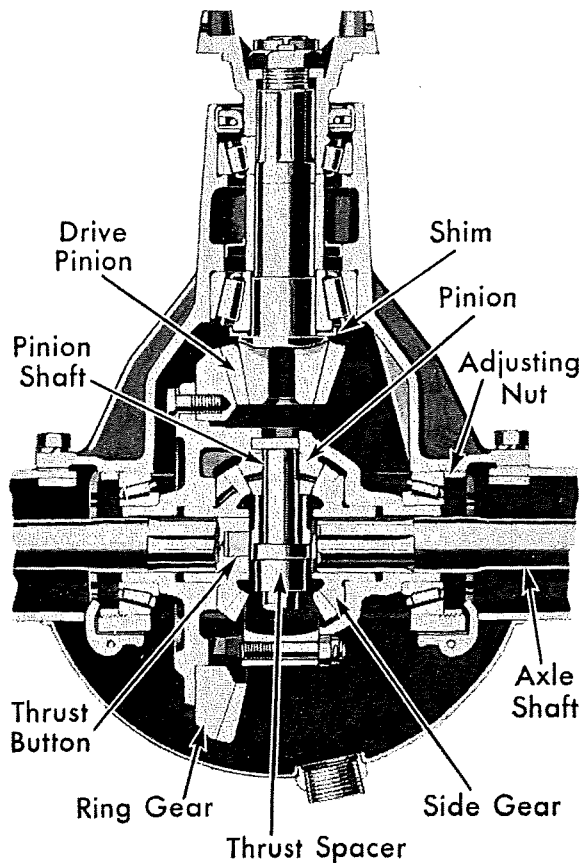


Fig. 138—Group No. 102 Rear Axle

bearing cones from the differential case hubs with a bearing puller. (12)—Remove the ring gear bolts and lock washers and remove the ring gear. (13)—Remove the cotter pins and nuts from the differential case stud. (14)—Separate the right and left side of the case and this will allow removal of the differential pinion shaft, the differential gears and thrust washers.

NOTE—The differential assembly must be removed before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

(15)—Remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (16)—With a suitable tool, pull off the universal joint drive flange. (17)—If it is just necessary to remove the oil seal, remove it from the pinion shaft with a puller. (18)—If the pinion is to be removed, pull it out through the rear end of the carrier case. (19)—The bearing spacer, front bearing and shims may then be removed from the housing. (20)—With a bearing puller, remove the rear bearing cone from the pinion shaft. Unless the ring gear and pinion are to be re-

placed with new parts, use care not to get the front bearing shims and the rear bearing shims mixed.

ASSEMBLE

(1)—If the differential assembly was satisfactory from a standpoint of noise, before the unit was disassembled, then the drive pinion may be assembled with the original shims or washer at the rear bearing. If new parts were installed or an adjustment was necessary, change these shims until the correct thickness is obtained to locate the pinion properly with relation to the ring gear. Play in the pinion shaft bearings is .000" to .001". (2)—To obtain this play, insert sufficient shims between the bearing spacer and the front bearing. If available, a dial indicator should be used to make this check. To make this adjustment, remove the drive pinion flange, oil seal, front bearing and then add or remove the required number of shims. (3)—Assemble the bearing, oil seal and flange, being sure to apply lubricant to the bearings before final assembly. (4)—Use a new cotter pin and lock washer when locking the flange in place. (5)—To assemble the differential, place the differential gear and thrust washer in the left differential case. Differential gear thrust washers are available in various thicknesses. Select the washers that will give no appreciable end play when the unit is reassembled. It is permissible to remove play to the extent that the differential gears can just be turned by hand when grasping the axle shafts. Install the washers with the rough side next to the differential case and the smooth side in contact with the differential gear. (6)—Assemble the differential pinion spacer and thrust washers on the differential pinion shaft and place them in the left differential case so that the hole in the shaft will line up with the pin in the case. (7)—Install the differential gear thrust washer and differential gear in the right differential case and assemble them to the left case. (8)—Replace the nuts on the differential case studs and tighten them securely. (9)—Insert and spread the cotter pins in all the studs. (10)—Place the ring gear on the differential case flange so that the holes line up properly. (11)—Install the lock washers and tighten the bolts. (12)—With a suitable bearing driver, install the differential bearing cones on the differential hubs. (13)—Install the differential in the carrier and assemble the bearing cups and differential bearing adjusting nuts, so that the ring gear and pinion teeth bottom. (14)—Install the differential bearing caps in place and insert cap screws and lock washers, drawing them up finger tight. Make sure that the lock washers are under the cap screws and are in good condition. (15)—Turn the left adjusting nut clockwise until no play can be felt between the drive gear and pinion shaft. (16)—Turn the right adjusting nut clockwise and draw it up tight. (17)—Mount a dial indicator on the differential flange and turn the left adjusting nut counterclockwise one half notch. (18)—Turn the right adjusting nut clockwise

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

one half notch. The backlash should be .006" to .010". (19)—If it is not correct, turn the adjusting nuts one half notch at a time until it is obtained. (20)—Tighten the left bearing cap screws. (21)—Turn the right differential bearing adjusting nut clockwise one full notch. This additional tightening provides the necessary spread to the differential carrier for proper operation. (22)—Draw up the cap screws tightly on the right differential bearing cap. (23)—Install the differential bearing adjusting nut locks and secure them with cotter pins. (24)—After this is correct, assemble the carrier in the rear axle housing. (25)—A new gasket and lock washers should be used whenever the carrier is removed from the housing. (26)—Pull up the cap screws evenly and securely. (27)—Assemble the axle shafts as described under AXLE SHAFT, REMOVE AND REPLACE chapter. (28)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (29)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

GROUP No. 103

Fig. 139

GRAHAM 1935-40;

HUPMOBILE 1935-40; LAFAYETTE 1934-35;

STUDEBAKER 1936-42

SPICER AXLE

DISASSEMBLE

(1)—Drain the oil from the differential by removing the drain plug in the cover. (2)—Remove the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (3)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (4)—Remove the bolts holding the cover to the axle shaft housing and then lift off the cover. (5)—Remove the four screws retaining the differential bearing caps and remove the caps. (6)—Firmly grip the differential case and ring gear assembly and pull it out toward the rear.

If it is just necessary to adjust the differential bearings, add or remove shims, as required, between the differential case and either differential bearing cone until the differential bearing cups will just slide into the housing when installed on the differential case assembly and bearing cones assembly. (7)—Remove the differential case assembly and pull off one of the differential bearing cones. (8)—Add an additional .008" to .010" shim between the bearing cone and the differential case. (9)—Reinstall the differential assembly in the housing and tighten the bearing cups if the bearings are properly adjusted, a considerable bearing drag will be noted when the ring gear is revolved by hand. (10)—After the differential bearings have been adjusted, it will be necessary to check the ring gear for backlash. (11)—If it is necessary to disassemble the differential it will be necessary to remove the ring gear, except on 1936 Studebaker Commander models.

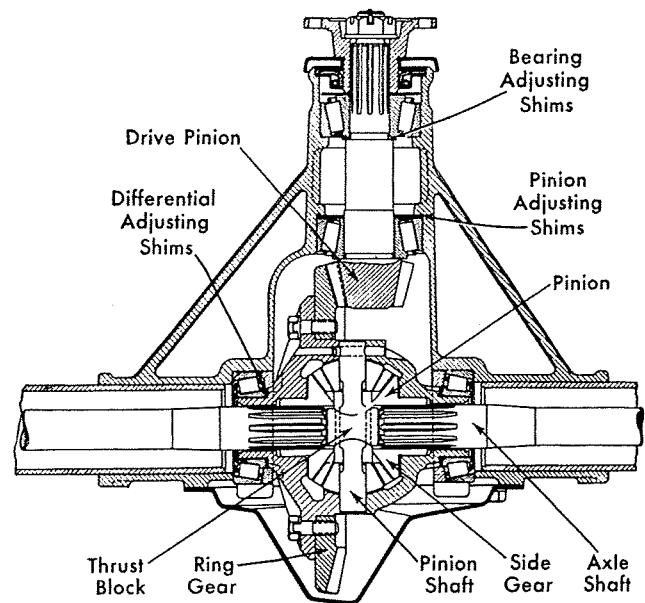


Fig. 139—Group No. 103 Rear Axle

(12)—To remove the ring gear, remove the bolts which hold the ring gear to differential case. (13)—Press the ring gear off the differential case. (14)—Remove the differential lock pin on Dictator models and the screw on others, and push out the differential pinion shaft, with a brass drift. (15)—The axle shaft thrust block can now be removed. (16)—By revolving the differential side gears by hand, the differential pinions and pinion thrust washers will come opposite the two holes in the case and can be withdrawn. (17)—The differential side gears and side gear thrust washers can now be removed through the holes in the case.

NOTE—The differential assembly must be removed from the axle housing before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

(18)—Remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (19)—With a suitable tool, pull off the universal joint drive flange, and dust shield assembly. (20)—The pinion should be pressed out of the front bearing toward the rear. (21)—It is important that the pinion is pressed and not driven out of the housing to prevent damage to the forward bearing. (22)—The oil retainer parts can then be pried out of the front of the housing. (23)—The pinion oil slinger and the front bearing can now be withdrawn from the housing.

ASSEMBLE

(1)—If the differential assembly was satisfactory from a standpoint of noise before the unit was disassembled it may be possible to assemble the drive pinion with the original shims. (2)—If new parts were

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

installed or an adjustment was necessary the shims can be changed to locate the pinion with relation to the ring gear, otherwise it is not necessary to remove the rear bearing cup. (3)—If the bearing cup was removed, insert the original shims between the pinion rear bearing cup and the pinion housing. (4)—If a new pinion is installed, press the rear bearing cone on the pinion shaft. (5)—Install the pinion and rear pinion bearing cone in the housing. (6)—Place a heavy brass drift against the head of the pinion so that the rear pinion bearing cone tightly contacts the bearing cup. (7)—With the pinion held in this position, pass the forward bearing cone over the shaft and tap the cone onto the shaft until it contacts with the shoulder of the pinion shaft and the shims. (8)—Install the flange and plain washer and securely tighten the nut, omitting the oil slinger, oil retainer and the gasket until the pinion and bearing adjustment have been checked. (9)—Revolve the pinion flange to check the bearing drag. (10)—The bearings will give the most satisfactory service when adjusted so as to produce a slight drag to rotation when the pinion is revolved by hand. (11)—If the bearing adjustment is not satisfactory, remove or add shims as required and recheck. (12)—When bearing play is correct, check the tooth contact of the ring gear and the pinion. (13)—To move the pinion toward the ring gear, add shims between the rear pinion bearing cup and pinion housing and add the same thickness of shims between the shoulder of the pinion shaft and the forward pinion bearing cone. (14)—To move the pinion away from the ring gear, remove an equal number of shims instead of adding them. This will not change the play in the bearings. (15)—When the bearing play and the position of the pinion are correct, remove the flange retaining nut, washer and flange. (16)—Place the pinion oil slinger over the pinion shaft and press the pinion oil retainer into the pinion housing. (17)—If extreme care was exercised in removing the oil retainer, it can be reinstalled; however, it is usually advisable to install a new retainer and retainer gasket. (18)—Install the flange, washer and flange retaining nut. (19)—The differential can be reassembled in the reverse order from which it was disassembled, making sure that the lock pin or screw for the differential shaft is securely locked. (20)—Make sure that the ring gear screws are drawn up uniformly and as tight as possible, and that they are locked in place. (21)—Special care must be taken to see that the ring gear bolt holes are chamfered on the back side of the ring gear. If they are not chamfered, the bolt holes on the ring gear side of the differential case flange must be chamfered. This will prevent causing a burr around the holes when the ring gear cap screws are drawn down and thus permit the ring gear to be drawn firmly and evenly against the flange. (22)—The backlash between the pinion and the ring gear should be .006" to .008". If it is less than .006", remove shims from between the left differential bearing cone and the case and install the same thickness of shims between the right differential bearing cone and the case until the correct backlash is obtained. If the backlash is in excess of .008", remove shims at the right

bearing and add the same thickness at the left bearing. Shifting the ring gear .005" will change backlash approximately .0035". (23)—The final check should be made with the differential bearing cap retaining screws securely tightened.

(24)—To move the ring gear away from the pinion, remove shims from the left differential bearing and add the same thickness to the right bearing. To move the ring gear toward the pinion, remove shims from the right differential bearing and add the same thickness to the left bearing.

(25)—Assemble the axle shafts as described under AXLE SHAFT, REMOVE AND REPLACE chapter. (26)—Replace the housing cover. (27)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (28)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

GROUP No. 104

Fig. 140

NASH 1941-42 SERIES 40

WILLYS 1936-1940

DISASSEMBLE

(1)—Drain the oil from the differential by removing the drain plug in the cover. (2)—Remove the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (3)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (4)—Remove the bolts holding the cover to the axle shaft housing and then lift off the cover. (5)—Before performing any other work check the back face of the ring gear for runout. Runout in excess of .003" indicates a sprung differential case or loose differential bearings. (6)—A sprung differential case should be replaced because it is impossible to straighten it properly. (7)—Remove the four screws retaining the differential bearing caps and remove the caps. (8)—If the caps are not already marked, mark them to indicate on which side of the differential they were installed. (9)—Firmly grip the differential case and ring gear assembly and pull it out toward the rear.

(10)—If it is just necessary to adjust the differential bearings, add or remove shims, as required, between the bearing seat in the axle housing and either differential bearing cup to provide a drive fit of .008" between the housing and the bearing cups. (11)—Remove the differential case assembly and the differential bearings. (12)—Add or remove shims between the bearing cup and the housing until the fit is correct. (13)—Reinstall the differential assembly in the housing and tighten the bearing cups. If the bearings are properly adjusted, a considerable bearing drag will be noted when the ring gear is revolved by hand. (14)—After the differential bearings have been adjusted, it will be necessary to check the ring gear for backlash.

(15)—If it is necessary to disassemble the differential

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

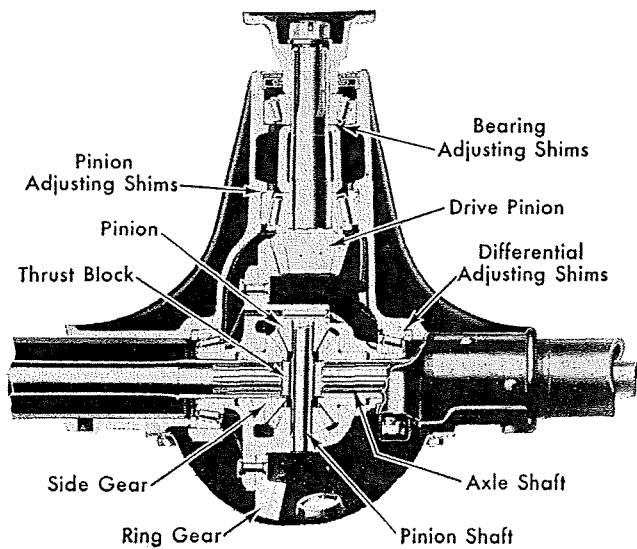


Fig. 140—Group No. 104 Rear Axle

remove the ring gear from the differential case. (16)—To remove the ring gear, remove the bolts which hold the ring gear to the differential case. (17)—Press the ring gear off the differential case. (18)—Remove the differential lock pin and push out the differential pinion shaft with a brass drift. (19)—The axle shaft thrust block can now be removed. (20)—By revolving the differential side gears by hand, the differential pinions and pinion thrust washers will come out opposite the two holes in the case and can be withdrawn. (21)—The differential side gears and thrust washers can now be removed through the holes in the case.

NOTE—The differential assembly must be removed from the axle housing before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

(22)—Remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (23)—With a suitable tool, pull off the universal joint drive flange and dust shield assembly. (24)—The pinion should be pressed out of the front bearing toward the rear. It is important that the pinion is pressed and not driven out of the housing to prevent damage to the front bearing. (25)—After the pinion is free of the front bearing it may be pulled out of the housing from the rear. (26)—The oil seal can then be driven out of the front of the housing. (27)—The pinion oil slinger and front bearing cone can now be withdrawn from the housing. (28)—If it is necessary to remove the rear bearing cone, it can be pressed off the pinion. (29)—If the rear bearing cup is to be replaced or if the pinion setting is to be changed, it is necessary to press the rear bearing cup from the housing.

ASSEMBLE

(1)—If the differential assembly was satisfactory from a standpoint of noise before the unit was disassembled it may be possible to assemble the drive pinion with the original shims. (2)—If new parts were installed or an adjustment was necessary, the shims can be changed to locate the pinion with relation to the ring gear. (3)—If the bearing cup was removed, insert the correct thickness of shims between the pinion rear bearing cup and the housing. (4)—With a pipe resting against the rear bearing cone, press it on the pinion. (5)—Install the pinion and rear bearing cone in the housing. (6)—Place a heavy brass drift against the head of the pinion so that the rear pinion bearing cone tightly contacts the bearing cup. (7)—With the pinion held in this position, pass the forward bearing cone over the shaft and tap the cone onto the shaft until it is tight against the bearing spacer and the shims. (8)—Install the flange and plain washer and securely tighten the nut, omitting the oil slinger, oil seal and gasket until the pinion and bearing adjustment have been checked. (9)—Revolve the pinion flange to check the bearing drag. The bearings will give the most satisfactory service when adjusted so as to produce a slight drag to rotation when the pinion is revolved by hand. (10)—If the bearing adjustment is not satisfactory, remove or add shims as required and recheck. (11)—Removing shims from the rear of the front bearing takes up play and adding shims increases the play. (12)—When bearing play is correct check the tooth contact of the ring gear and pinion. (13)—To move the pinion toward the ring gear, add shims between the rear bearing cup and pinion housing and add the same thickness of shims between the pinion bearing spacer and the front pinion bearing cone. (14)—To move the pinion away from the ring gear, remove an equal number of shims instead of adding them. This will not change the bearing play. (15)—When the bearing play and the position of the pinion are correct, remove the flange retaining nut, washer and flange. (16)—Place the pinion oil slinger over the pinion shaft and press the pinion oil seal into the pinion housing. (17)—If extreme care was exercised in removing the oil seal, it can be reinstalled; however, it is usually advisable to install a new retainer and retainer gasket. (18)—Install the flange, washer and flange retaining nut.

(19)—The differential should be assembled in the reverse order from which it was disassembled. (20)—Peen some of the metal over the lock pin for the differential shaft to be sure that it is securely locked. (21)—Make sure that the ring gear screws are drawn up uniformly and as tight as possible, and that they are locked in place. Special care must be taken to see that the ring gear bolt holes are chamfered on the back side of the ring gear. If they are not chamfered, the bolt holes on the ring gear side of the differential case flange must be chamfered. This will prevent a burr being thrown up around the holes when the ring gear

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

cap screws are drawn down and thus permit the ring gear to be drawn firmly and evenly against the flange.

(22)—The backlash between the pinion and the ring gear should be .006" to .008". (23)—If it is less than .006", remove shims from between the differential bearing cup and the housing and install the same thickness of shims between the differential bearing cup and the housing until the correct backlash is obtained. (24)—If the backlash is in excess of .008", remove shims at the right bearing and add the same thickness at the left bearing. Shifting the ring gear .005" will change backlash about the same amount. (25)—The final check should be made with the differential bearing cap retaining screws securely tightened.

(26)—Assemble the axle shafts as described under AXLE SHAFT, REMOVE AND REPLACE chapter. (27)—Replace the housing cover. (28)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (29)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

GROUP No. 105

Fig. 141

PACKARD 6-110, 8-120 1936-1942

DISASSEMBLE

(1)—Drain the oil from the differential by removing the plug at the bottom of the rear axle housing. (2)—Remove the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (3)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (4)—Remove the cap screws which hold the differential carrier to the axle housing and lift out the differential carrier. (5)—Mount the carrier on a bench or fasten it in a vise. (6)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (7)—Remove the differential bearing cap screws and lift off the caps. (8)—With a puller, remove the differential bearings. (9)—Lift out the differential and ring gear assembly.

(10)—To disassemble the differential and ring gear assembly, remove the bolts which hold the ring gear to the differential case. (11)—Press the ring gear off the differential case. (12)—Remove the differential pinion shaft lock pin and push out the differential pinion shaft. (13)—All differential parts will then be loose and can be removed by hand.

NOTE—The differential assembly must be removed before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

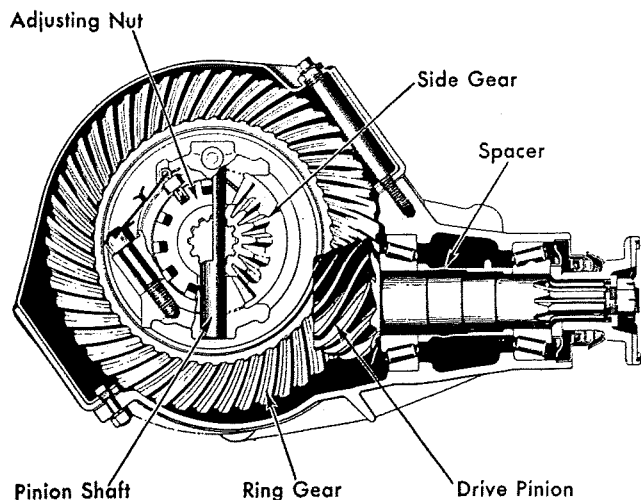


Fig. 141—Group No. 105 Differential Assembly

(14)—Remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (15)—With a suitable tool, pull off the universal joint drive flange. (16)—Remove the oil seal from the front of the housing with a puller. (17)—If the pinion is to be removed, press it out of the front bearing through the rear end of the carrier housing. (18)—The rear bearing cone and spacer will come out with the pinion. (19)—The bearing spacer and front bearing can then be removed from the front of the housing. (20)—If necessary, remove the rear bearing cone from the pinion shaft with a bearing puller.

ASSEMBLE

NOTE—The drive pinion mesh with the ring gear is fixed and no shims are used at the bearings in the differential case housing.

(1)—If the rear bearing cup was removed from the housing or was replaced with a new bearing, press the bearing cup in the housing. (2)—Press the rear bearing cone on the pinion shaft. (3)—Press the front bearing cup in the front of the housing and then slide the pinion and rear bearing cone into the housing from the rear. (4)—Slip the bearing spacer on the pinion shaft against the rear bearing and then press the front bearing cone on the pinion shaft. (5)—Then install the narrow spacer on the pinion shaft at the front of the front bearing. (6)—If the oil seal was removed, press a new one into the housing. (7)—Install the universal joint flange, plain washer and nut on the pinion shaft. (8)—Then tighten the nut until the bearings have a preload drag of 25 to 30 inch pounds. This adjustment must be made every time the flange nut is loosened or removed. (9)—To obtain the preload, the nut must be tightened until it buckles the spacer between the front and rear bearings sufficiently to require a pull of 5 to 6 pounds, measured on a wrench handle 5 inches

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

from the socket, to rotate the pinion shaft. (10)—If the carrier is not out of the rear axle when this adjustment is made, both wheels must be jacked up off the floor.

(11)—To assemble the differential, press the differential bearings in place. (12)—Install the side gear thrust washers and side gears in the case. (13)—Mesh the differential pinions with side gears, holding the thrust washers on the back of the gears. (14)—Rotate the side gears until the holes through the center of the pinions are in line with the hole for the pinion shaft, in the case. (15)—Push, do not drive, the pinion shaft in place so that the hole in the shaft for the lock pin registers with the hole in the case. (16)—Then install the lock pin. (17)—Locate the differential case in the carrier. (18)—Install the differential bearing caps and adjusting nuts. (19)—Draw up on the adjusting nuts until the marks which you made on the bearing adjusting nuts and caps indicate that the bearings are in their original position. (20)—Then tighten the cap screws in the bearing cap.

ADJUSTMENT

(21)—The differential side bearings should be preloaded to a .010" to .012" spread of the bearing support pedestals. (22)—To adjust this spread, loosen each bearing cap just slightly and then back off the right adjusting nut until the ring gear mount is loose in the bearings. (23)—Make sure that the left adjusting nut is backed out far enough to provide some backlash between the ring gear and the pinion. (24)—Use a large outside caliper and a .010" feeler blade to make this check. (25)—With caliper, measure from the finished boss of one bearing cap to the other with the .010" feeler blade interposed between one of the bosses and the caliper. (26)—Lock the caliper at this setting. (27)—Now tighten the right bearing adjusting nut until the caliper, minus the .010" feeler gauge will just slide over both cap bosses. The recommended pinion to ring gear backlash is .003" to .005". (28)—If the lash is more than .005", back off the right adjusting nut and tighten the left nut exactly the same amount until lash is within the .003" to .005" limit. (29)—By turning each adjusting nut exactly the same amount, backlash may be adjusted without disturbing the previously adjusted spread. (30)—Tighten the bearing caps and lock them in position. (31)—After this is correct, assemble the carrier in the rear axle housing. (32)—A new gasket and lock washers should be used whenever the carrier is removed from the housing. (33)—Pull up the cap screws evenly and securely. (34)—Assemble the axle shafts as described under AXLE SHAFT, REMOVE AND REPLACE chapter. (35)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (36)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

GROUP No. 106

Fig. 142

LAFAYETTE 3610, 3710, 3810, 3910; 1936-39
WITH NASH AXLE

NASH 3720, 3820, 3920, 3980, 4020, 4080,
4160, 4180, 4260, 4280

DISASSEMBLE

(1)—Drain the oil from the differential by removing the drain plug in the cover. (2)—Remove the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (3)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (4)—Remove the bolts holding the cover to the axle shaft housing and then lift off the cover.

NOTE—(a)—If it is just necessary to adjust the differential bearings, it will only be necessary to loosen the screws in the bearing caps instead of removing them. (b)—Then remove the lock wire and screw holding the lock for the adjusting nut at the outside of the right bearing. (c)—Turn the nut to tighten it against the bearings until there is no side movement in the bearings and then tighten it two additional

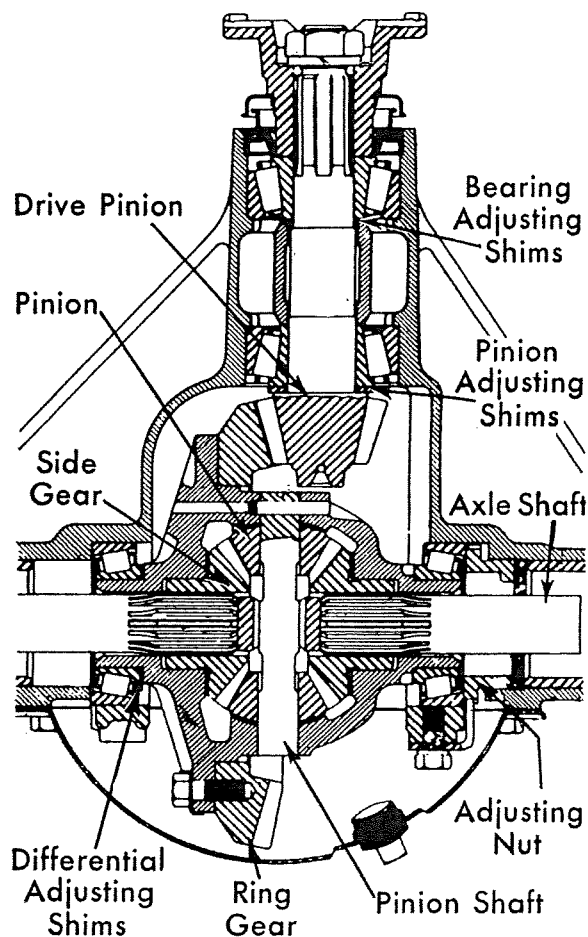


Fig. 142—Group No. 106 Rear Axle

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

notches. (d)—Replace the adjusting nut lock and put a wire through the head of the screw to hold the adjustment.

(5)—Remove the four screws retaining the differential bearing caps and remove the caps. (6)—If the caps are not already marked, mark them to indicate on which side of the differential they were installed. (7)—Firmly grip the differential case and ring gear assembly and pull it out toward the rear.

(8)—If the backlash between the ring gear and the pinion requires an adjustment, pull the bearing cone from the left side of the differential case. (9)—Then add or remove shims between the bearing cone and the differential case to move the ring gear toward or away from the ring gear until tooth contact is correct. (10)—Reinstall the differential assembly in the housing and tighten the bearing caps. (11)—If it is necessary to disassemble the differential, remove the ring gear from the differential case. (12)—To remove the ring gear, remove the bolts which hold the ring gear to the differential case. (13)—Press the ring gear from the differential case. (14)—Remove the differential lock pin and push the differential pinion shaft with a brass drift. (15)—The axle shaft thrust block can now be removed. (16)—By revolving the differential side gears by hand, the differential pinions and pinion thrust washers will come out opposite the two holes in the case and can be withdrawn. (17)—The differential side gears and thrust washers can now be removed through the holes in the case.

NOTE—The differential assembly must be removed from the axle housing before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

(18)—To remove the drive pinion, remove the drive pinion flange nut and washer from the front end of the pinion shaft. (19)—With a suitable tool, pull off the universal joint drive flange and dust shield assembly. (20)—The pinion should be pressed out of the front bearing toward the rear. It is important that the pinion is pressed and not driven out of the housing to prevent damage to the front bearing. (21)—After the pinion is free of the front bearing it may be pulled out of the housing from the rear. (22)—The oil seal can be driven out of the front of the housing. (23)—If it is necessary to replace the pinion or to change the setting of the pinion, press the bearing cone off the pinion. (24)—If the rear bearing cup is to be replaced, it is necessary to press the cup from the housing.

ASSEMBLE

(1)—If the differential assembly was satisfactory from a standpoint of noise before the unit was disassembled, it may be possible to assemble the drive pinion in the housing with the original shims. (2)—If new parts were installed or an adjustment was neces-

sary to move the pinion with relation to the ring gear, install the correct thickness of shims on the pinion.

(3)—With a pipe resting against the rear bearing cone, press it on the pinion shaft until it is tight against the shims. (4)—If the rear bearing cup was removed, press it into the housing. (5)—Install the pinion bearing and cone in the housing. (6)—Place a heavy drift against the head of the pinion so that the rear pinion bearing cone tightly contacts the bearing cup. (7)—With the pinion held in this position, pass the spacer, shims and front bearing cone over the shaft and tap the cone onto the shaft until it is tight against the bearing spacer and shims. (8)—Install the flange and plain washer and securely tighten the nut, omitting the oil seal until the pinion adjustment has been checked. (9)—Check the tooth contact of the ring gear and pinion. (10)—To move the pinion toward the ring gear, add shims between the pinion and the rear bearing cone and add the same thickness of shims between the pinion bearing spacer and the front bearing cone. (11)—To move the pinion away from the ring gear, remove an equal number of shims instead of adding them. This will not change the bearing play. The pinion shaft bearings are adjusted with a .003" preload. (12)—To check this adjustment, install sufficient shims so that an indicator reading can be obtained. (13)—In checking the end play, use an indicator gauge and oscillate the pinion shaft in both directions applying pressure while making the check so that the roller bearings will seat in their cups. (14)—Note the end movement and remove shims from behind the front bearing the amount of the end play plus .003". (15)—When this adjustment is correct, remove the nut and flange from the pinion shaft and install a new oil seal. (16)—Install the flange, washer and flange retaining nut and tighten them in position.

(17)—The differential can be assembled in the reverse order from which it was disassembled. (18)—Peen some of the metal over the lock pin for the differential shaft to be sure that it is securely locked. (19)—Make sure that the ring gear screws are drawn up uniformly and as tight as possible, and that they are locked in place. (20)—Special care must be taken that the ring gear bolt holes are chamfered on the back side of the ring gear. If they are not chamfered, the bolt holes on the ring gear side of the differential case flange must be chamfered. This will prevent a burr from being thrown up around the holes when the ring gear cap screws are drawn down and thus permit the ring gear to be drawn firmly and evenly against the flange.

(21)—Assemble the axle shafts as described under **AXLE SHAFT, REMOVE AND REPLACE** chapter. (22)—Replace the housing cover. (23)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (24)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

GROUP No. 107

Fig. 143

FORD 1933-42 PASSENGER CARS
FORD 1933-39 COMMERCIAL CARS
LINCOLN ZEPHYR 1936-37
MERCURY 1939-42

DISASSEMBLE

Remove the rear axle assembly as follows: (1)—Disconnect the rear spring from the axle housing. (2)—Unfasten the radius rods from the torque tube at the front. (3)—Remove the bolts which attach the torque tube to the differential housing and slide the torque tube from the propeller shaft. (4)—Drive out the rivet which fastens the propeller shaft to the drive pinion and remove the shaft. (5)—Remove the bolts which attach both axle housings to the differential housing and take off the housings. (6)—Mark the two halves of the differential case so they may be assembled in the same position, then remove the differential case attaching bolts and separate the case. (7)—Pick out the differential spider and pinions. (8)—Withdraw the axle shafts. (9)—Remove the drive pinion and bearings from the housing as a unit. (10)—Unscrew the drive pinion lock nut and adjusting nut and use a puller to remove the bearings and bearing cup.

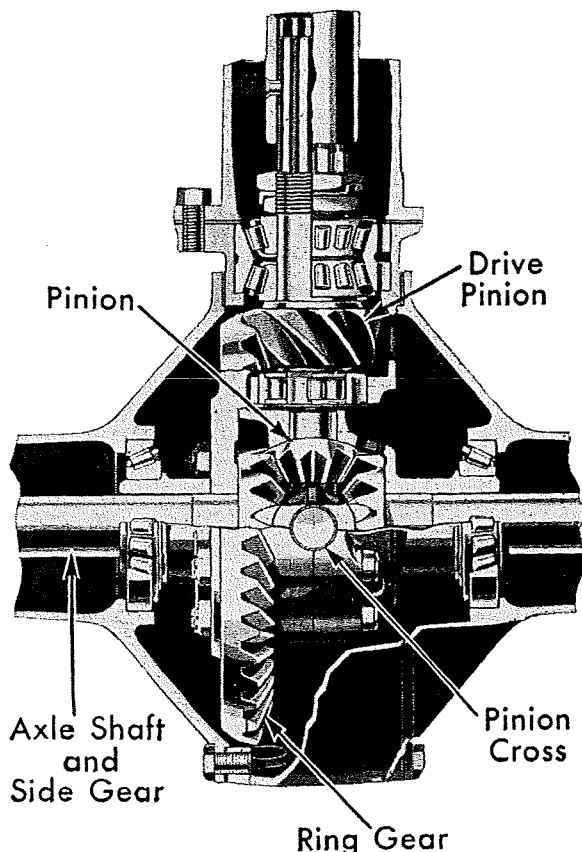


Fig. 143—Group No. 107 Rear Axle

INSPECTION

(1)—Examine the differential case for wear at the point where the back faces of the differential pinion and side gears contact the two halves of the case; if wear appears to be excessive, install a new case. (2)—Examine the axle shafts for wear on the taper, damaged keyways or threads, and see that the gear teeth are not worn excessively; if the back face of the gears are scored, or if any of the conditions mentioned are evident, replace the shaft.

(3)—If the bearing surface of the propeller shaft is worn to .005" undersize, replace the propeller shaft, the bearing and sleeve. (4)—Examine the axle housings to see if the wheel bearing surfaces are scored, pitted or worn more than .010" undersize for more than $\frac{3}{4}$ " of its length; if so, replace the housing. (5)—The grease retainers in the axle housings and the torque tube should always be replaced when the axle is overhauled. Install the grease retainer in the torque tube with the sharp edge of the leather toward the individual joint; the grease retainers in the axle housings should be assembled with the sharp edge of the leather toward the differential. (6)—No attempt should be made to straighten badly bent radius rods as this practice usually elongates the rods, thereby changing the center line angle of the torque tube and the axle, placing a severe strain on the internal parts of the differential which results in rapid wear of these parts and misaligned rear wheels.

ASSEMBLE

(1)—Install the pinion bearings and bearing cup on the drive pinion, adjusting the bearing lock nuts so that the cup turns on the cones with a heavy drag and no end play. (2)—Before installing the pinion assembly in the housing, be sure the shoulder of the housing is clean and free from burrs. (3)—Use a blow torch to heat the neck of the differential housing and drive the outboard bearing in position. While the housing is still hot, install the drive pinion assembly, being sure that the bearing cup is against the shoulder of the housing. NOTE—If a torch is not available, the housing may be heated by immersing it in boiling water or heated oil for about two minutes. A light film of grease applied to the outer surface of the bearing cup will facilitate the installation of the cup. (4)—Assemble the differential bearing cups in the axle housings. NOTE—A puller is recommended for this operation. (5)—Install the axle shaft in the right half of the differential case. Assemble the pinions on the spider and install in the right half of the differential case, meshing the pinions with the axle shaft gear. NOTE—The pinions should be free-turning on the spider with about .005" clearance. (6)—Slip the other axle shaft in the left half of the differential case and through the drive gear, bolting the assembly together securely, after which, install locking wire through all the bolts. NOTE—Any burrs which may be present on the contacting surfaces of the differential case must be removed before assembling the differential. (7)—Check the backlash in the axle shaft gears by fastening one shaft in a vise.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

Then turn the other shaft by hand as far as possible in one direction and then in the opposite direction. NOTE—The allowable travel, checked at the axle shaft keyway should not exceed .010"; if the backlash exceeds this amount, check the axle shaft end play, which should not be greater than .015" on either shaft. If the end play is in excess of .015", it indicates excessively worn parts or the two halves of the differential case are not seated properly. However, if the end play is not excessive, and the axle gear backlash is more than .010", it indicates that the teeth of some of the gears are badly worn. (8)—Fasten the right hand axle housing to the differential housing, using a new gasket, which is from .008" to .010" thick (part No. 18-4035-A). (9)—Install the differential assembly to the left hand housing. (10)—Assemble the left hand housing and differential assembly to the differential housing, pushing the right hand axle shaft through its housing, after which, bolt the left axle housing to the differential housing, using a new gasket, which is from .008" to .010" thick (Part No. 18-4035-A). (11)—The differential bearing clearance is then checked by turning both axle shafts in the same direction at the same time and at about the same speed (two persons are required for this operation). If the clearance is correct, a heavy drag will be evident when the differential is turned on its bearings. NOTE—Turning only one shaft will not revolve the differential on its bearings. (12)—If too much clearance is apparent, remove the right hand axle housing and install gasket number B-4035-BR which is from .004" to .005" thick, then check the clearance again. (13)—Now check the backlash between the drive pinion and the ring gear by using a dial indicator at the splines on the pinion shaft which should not be less than .003" nor more than .008". If the backlash is too great, install a thinner gasket between the left hand axle housing and the differential housing. Similarly, if there is not sufficient backlash, install a thicker gasket between the left hand housing and the differential housing. CAUTION—To preserve the correct differential bearing clearance, whatever gasket thickness is added to the left hand housing must be removed from the right hand housing; whatever gasket thickness is removed from the left hand housing, must be added to the right hand housing. (14)—Assemble the propeller shaft to the drive pinion shaft, fastening them together with a rivet. (15)—Install the torque tube to the differential housing and complete the assembly in the reverse order of removal.

described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (3)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (4)—Remove the cap screws which hold the differential carrier to the axle housing and lift out the differential carrier. (5)—Mount the carrier on a bench or fasten it in a vise. (6)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (7)—Remove the differential bearing cap screws and lift off the caps. (8)—With a puller, remove the differential bearings. (9)—Lift out the differential and ring gear assembly.

(10)—To disassemble the differential and ring gear assembly, remove the bolts and lockwasher, which hold the ring gear to the differential case. (11)—Press the ring gear off the differential case. (12)—Remove the differential pinion shaft lock screw and push out the differential pinion shaft. (13)—All differential parts will then be loose and can be removed by hand.

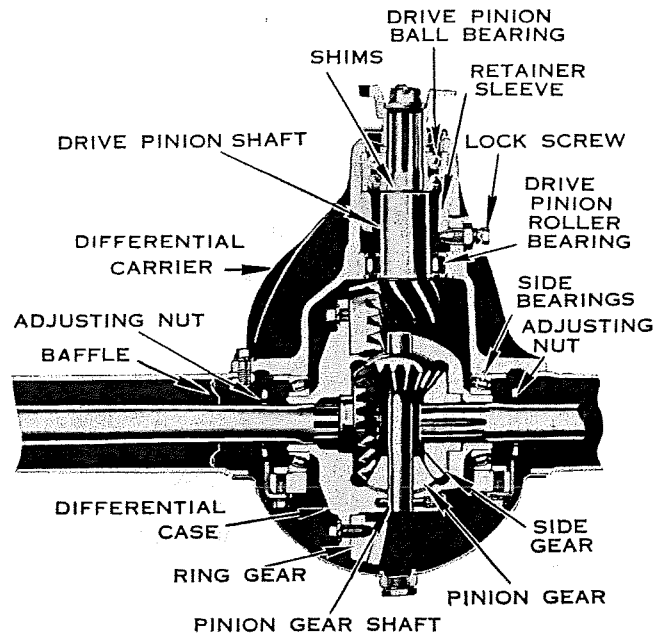


Fig. 144—Group No. 108 Rear Axle

GROUP No. 108

Figs. 144, 145

OLDSMOBILE 1937-1942

PONTIAC 1937-1942

DISASSEMBLE

(1)—Drain the oil from the differential by removing two bottom cap screws which fasten the carrier to the rear axle housing. (2)—Remove the axle shafts as

NOTE—The differential assembly must be removed before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal. (14)—Remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (15)—With a suitable tool, pull off the universal joint drive flange. (16)—If it is just necessary to remove the oil seal, remove it from the housing with a puller. (17)—If the pinion is to be removed, force the pinion

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

shaft back through the ball bearing inner race by means of an arbor press and remove it at the rear. (18)—Note the total thickness of shims at the rear of the double row ball bearing as they control the position of the pinion in the carrier, and the pinion may be replaced in its original position, if necessary. There is a snap ring on the drive pinion shaft just ahead of the rear bearing to prevent the rollers of the bearing from working back and contacting with the face of the pinion. (19)—The outer race of the rear bearing is pressed into the differential carrier and the race for this bearing can be removed with a suitable puller, after the pinion and rollers have been removed. **NOTE**—After the roller bearing has been running some time under load, the rollers may be removed singly from the bearing. Under these conditions, the roller outer bearing may be removed with the puller. (20)—It is not possible to pull a new roller bearing from the carrier with the puller. (21)—When it is necessary to remove a new pinion roller bearing assembly, it must be removed by loosening the three lock screws for the pinion roller bearing sleeve and press the roller bearing through the rear of the differential carrier by applying force to the roller bearing under the arbor press. (22)—After the shaft and the outer race of the rear bearing have been removed, the double row ball bearing may be removed by backing out the three bearing lock screws, removing sleeve and tapping the bearing from the housing.

ASSEMBLE

NOTE—The diameter of the pinion shaft at the roller path should be checked with a micrometer and if more than .0007" undersize when compared with the unused portion of the shaft, a noisy gear will probably result and the ring gear and pinion should be replaced. If the roller shaft does not show excessive wear but excessive radial clearance is observed in the roller bearing when the pinion is assembled in the carrier and forced up and down with the hand, then a new roller bearing is required. The double row ball bearing is built with a slight preload and should not have any end play between the inner and the outer races. If the balls have worn so that there is end play, the bearing must be replaced. Check the differential bearings for rough spots, then rotate the bearings and observe if they run smoothly.

(1)—Push the front double row ball bearing into the housing and tap lightly on the outer race of the bearing, if necessary. (2)—With the tapered end of the bearing retainer sleeve toward the rear, slide the sleeve up against the ball bearing outer race and lock it in place with the three pointed lock screws. (3)—With a suitable tool, press the roller bearing outer race in place. (4)—Coat the fourteen rollers with heavy grease and replace the bearings in the race. (5)—Insert the shims on the pinion shaft and press the shaft into place,

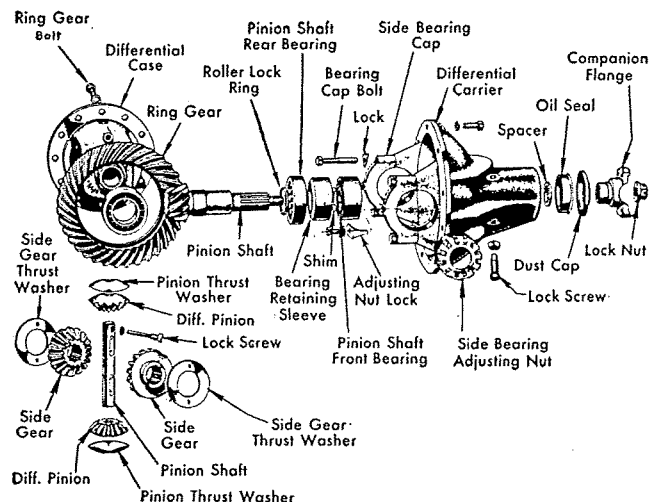


Fig. 145—Group 108 Rear Axle

using heavy grease on the shims to hold them in place. (6)—Insert the universal joint flange on the splines of the pinion drive shaft. (7)—Holding the flange in a vise, install the plain washer and tighten the nut. Install the cotter pin. (8)—To assemble the ring gear and case, press the differential bearings in place on the case with a suitable tool. (9)—Install the differential side gear thrust washers and side gears, either face of the washer may be used next to the gear hub. (10)—Put the differential pinion gears in mesh with the differential side gears, holding the thrust washers on back of the gears, then rotate the differential side gears until the holes through the center of the pinion align with the hole for the shaft in the differential case. (11)—Push, do not drive, the pinion gear shaft in place so that the hole in the shaft for the lock screw aligns with the hole in the differential case. (12)—Install the pinion shaft lock screw, with the lock washer under the head. (13)—Replace the case in the carrier. (14)—Put the differential bearing caps and nuts in line with the marks previously marked on the parts and tighten the caps. (15)—Then back off each bearing cap bolt a half turn. (16)—Back off the right adjusting nut 4 turns. (17)—Tighten the left nut against the bearing race, removing all lash between the ring gear and pinion. (18)—Then back the nut off 4 notches, leaving the slot in the adjusting nut in line with the lock slot in the bearing cap. (19)—Tighten the right adjusting nut, watching the race of the bearing. (20)—When the bearing starts to turn, indicating tension on the bearing, continue to tighten the nut 3 more notches. (21)—Then back off the nut until the bearing race stops turning. (22)—Again tighten the nut until the race starts to turn. (23)—Then tighten the nut $1\frac{1}{2}$ to 2 notches to make a slot in the nut line up with the lock slot in the bearing cap. (24)—Tighten the bearing cap bolts. (25)—Clamp an indicator to the

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

differential carrier and check the backlash which should be .004" to .008". (26)—If necessary, loosen the bearing cap bolts and adjust the bearing nuts to obtain the correct lash. (27)—Always turn both nuts an equal number of notches. (28)—Tighten the bearing caps securely and install the adjusting nut locks and cap screws. (29)—Check the tooth contact and if it necessary to move the ring gear toward or away from the pinion, turn both differential bearing adjusting nuts an equal number of turns in the same direction. (30)—If it is necessary to move the pinion away from or toward the ring gear, the shims at the rear of the pinion double row ball bearing must be changed. (31)—After this is correct, assemble the carrier in the rear axle housing. (32)—A new gasket and lock washers should be used whenever the carrier is removed from the housing. (33)—Pull up the cap screws evenly and securely. (34)—Assemble the axle shafts as described under AXLE SHAFT, REMOVE AND REPLACE chapter. (35)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (36)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

GROUP No. 109

Fig. 146

BUICK 1936-42 EXCEPT 36-90

DISASSEMBLE

(1)—Remove the rear axle assembly and the axle shaft as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (2)—Remove the cap screws which hold the differential carrier to the axle housing and remove the differential carrier housing and torque tube from the rear axle housing. (3)—Place the unit in the vise. (4)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (5)—Remove the differential bearing cap screws and lift out the differential assembly.

(6)—To disassemble the differential, remove the differential bearings from the differential case with a bearing puller. (7)—Clean, oil and check the bearings for roughness. (8)—If it is just necessary to replace the bearings, use a suitable driver to replace the bearings. The thick side of the inner race must be next to the case on each side. (9)—Check the ring gear for looseness. (10)—If it is necessary to remove the ring gear, use a $\frac{3}{8}$ " drill to remove the rivet heads. Drill from the ring gear side. Do not cut off the heads of the rivets with a cold chisel as the differential case may be disturbed. (11)—Back up the case or gear flange solidly around the rivet head and carefully drive out the rivets. (12)—Tap off the ring gear with a soft hammer. (a)—After removing the ring gear, inspect

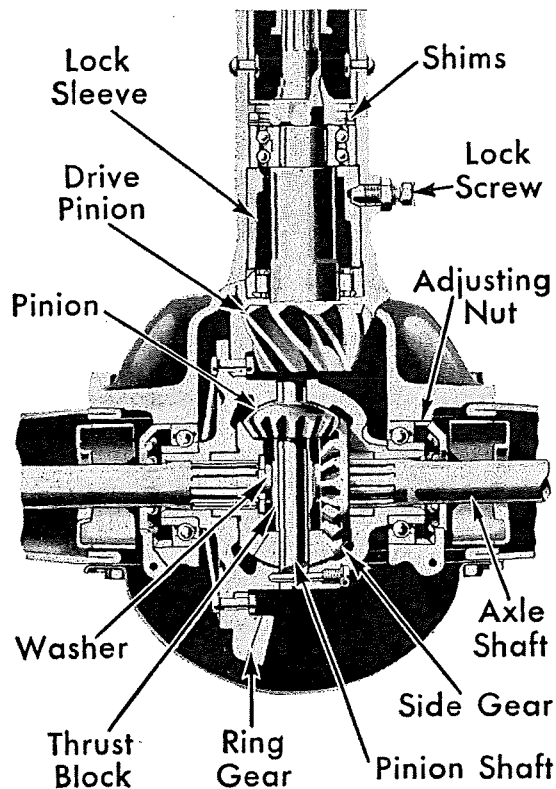


Fig. 146—Group No. 109 Rear Axle

the case flange for gear seat runout, using a dial indicator and turning the case in V-blocks on its bearing hubs. (b)—If the runout is in excess of .002" set the case up in a lathe and true up the gear seat. (c)—Recheck in V-blocks. (d)—Remove burrs at the rivet holes in the case flange. (13)—As the differential pinion shaft was removed to remove the axle shaft, all differential parts are loose and can be removed by hand. (14)—To remove the drive pinion and propeller shaft, remove the three cap screws with lock nuts on the side of the differential carrier housing. (15)—Remove the propeller shaft and pinion from the housing. If it will not come out readily, bump its splined end on a wooden block to loosen it. (16)—Remove the shims from the torque tube at the front bearing seat. (17)—Keep the shims together so that the original assembly may be maintained. (18)—Inspect the splines for wear or looseness on the universal joint and examine the propeller shaft. (19)—Clean and oil the bearings and check for roughness. (20)—Check the double row ball bearings for end play. (21)—If there is end play in this bearing it should be replaced, as end play will allow the pinion to move in and out of mesh with the ring gear. (22)—Examine the pinion for cracked, chipped or scored teeth.

(23)—To disassemble the pinion from the propeller shaft for replacement of the pinion or bearing, cut the head off the pin which holds the two parts together.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

(24)—Drive out the pin and with a suitable puller, separate the shafts. (25)—Remove the lock nut from in front of the double row bearing and press off the bearing. (26) Remove bearing sleeve, roller bearing and spacer.

ASSEMBLE

(1)—Assemble spacer and roller bearing on pinion shaft. (2)—Install the sleeve with the screw holes toward the front. (3)—Press on the double row bearing. (4)—Install a new lock nut loosely. (5)—Heat propeller shaft to about 450° to allow for press fit. Press the pinion shaft into the propeller shaft so that the rivet holes in both parts are in alignment. (6)—Install a pin in the hole and rivet both ends. (7)—Tighten the bearing lock nut and lock it in the slot of the pinion shaft. (8)—Insert the shims in the torque tube. (9)—Install the pinion and propeller shaft in the differential housing, and tap the outer race of the roller bearing forward. If this is not done, bearing rollers will bind the spacer, damaging both roller bearing and pinion. The heads of some pinions are larger than the roller bearing O.D. making it necessary to use a special U-shaped tool between the pinion and roller bearing. Then use a soft-faced mallet or bronze driving block on the pinion end to properly seat the roller bearing outer race. (10)—Insert the three pointed lock screws in the side of the housing and draw them down evenly and securely. (11)—Then tighten the lock-nuts. (12)—If the ring gear was removed, bolt the gear to the case, using six $\frac{5}{16}$ " diameter bolts and draw them up securely, leaving a hole open between each bolt for riveting. (13)—Use only new rivets that fill the hole completely and that leave approximately $\frac{5}{16}$ " of shank for heading. (14)—Place the gear and case in a riveting fixture and, using the proper rivet set, head up opposite rivets. Start riveting with rivet head on differential flange side. Do not work around the gear in riveting as the gear is liable to be drawn to one side and run eccentric. (15)—Remove the bolts and finish riveting as already described. (16)—The runout should not exceed .006" when checked at the back of the gear. (17)—Before assembling the differential, examine the side gear bearing surfaces in the differential case and the thrust surfaces on the side and pinion gears. (18)—See that the hubs and splines of these gears are in good condition and that the side gear splines are a good fit on the axle shafts. (19)—Also check the fit of the pinion gears on the pinion shaft. (20)—If any of the parts are worn, they should be replaced. (21)—Press the differential bearing in place. (22)—Locate the differential case in the carrier. (23)—Install the differential bearing caps and adjusting nuts. (24)—Draw up on the adjusting nuts until the marks indicate that the bearings are in their original position. (25)—To adjust the differential bearings, back off the right bearing cap screws $1\frac{1}{2}$ turns and tap

the cap lightly with a hammer to free the race and adjusting nut. (26)—Mark the position of both adjusting nuts. (27)—Watch the outer race of the right bearing turn with the adjusting nut as the nut is slowly backed off and stop when the race stops turning. (28)—Mark this new position of the adjusting nut and return it to its original position. (29)—Repeat backing off the adjusting nut and again stop when the bearing race stops turning with the nut. This should be the same as before and the number of notches between the original position and the free position of the nut are the "notches tight" of the bearing. The correct adjustment is not less than one nor more than two notches tight. If the bearing race did not turn when backing off the adjusting nut, the bearings have "lapped" free, or one of the bearings has "locked" and turned on the hub of the differential case. (30)—Before investigating further, determine how loose the bearing was by drawing up the adjusting nut until the outer race just starts to turn with the nut. (31)—Equalize the adjustment between the right and left bearings. (32)—Draw down the cap screws lightly and tap both caps with a hammer to permit seating of the bearings. (33)—Then tighten the cap screws. (34)—Now check the backlash between the ring gear and the pinion. It should be from .006" to .008". (35)—If it is too great, loosen the right adjusting nut and tighten the left nut one notch. Do this until the backlash is correct. (36)—If the backlash is too small, loosen the left adjusting nut and tighten the right nut. (37)—Check tooth contact and turn the adjusting nuts to move the ring gear toward or away from the pinion. (38)—It will be necessary to remove the pinion from the torque tube and change the number of shims at the front bearing to move the pinion. (39)—Now tighten the bearing cap lock screws securely and recheck the backlash. When correct, install the adjusting nut locks and lock the adjustment. (40)—After this is correct, assemble the carrier in the rear axle housing. A new gasket and lock washers should be used whenever the carrier is removed from the housing. (41)—Pull up the cap screws evenly and securely. (42)—Lubricate the hubs of the differential side gears with rear axle lubricant and install them in the differential case, holding the thrust washer at the back of the gears. (43)—Then install the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (44)—Spread the ends of the axle shafts to make sure that the shafts, locks and differential side gears are in positive contact. (45)—Roll the two differential pinions into place, holding the thrust washer at the back of the pinion. (46)—Install the axle shaft spacer, pinion gear shaft and lock screw. (47)—Then check the clearance between the end of the axle shaft and the spacer as described in the AXLE SHAFT chapter. (48)—Install the housing cover, using a new gasket and fill the housing to its proper level with the correct lubricant.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

GROUP No. 110

Fig. 147

BUICK 90-1936

DISASSEMBLE

(1)—Remove the rear axle assembly and the axle shaft as described in the **AXLE SHAFT, REMOVE AND REPLACE** chapter. (2)—Remove the cap screws which hold the differential carrier housing and torque tube from the rear axle housing. (3)—Place the unit in a vise. (4)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (5)—Remove the differential bearing cap screws and lift out the differential assembly.

(6)—To disassemble the differential, remove the differential bearings from the differential case with a bearing puller. (7)—Clean, oil and check the bearings for roughness. (8)—If it is necessary to replace the bearings, use a suitable driver and force the bearings onto their seat. The thick side of the inner race must be next to the case on each side. (9)—Check the ring gear for looseness. (10)—If it is necessary to remove the ring gear, use a $\frac{3}{8}$ " drill to remove the rivet heads. Drill from the ring gear side. Do not cut off the heads of the rivets with a cold chisel as the differential case may be disturbed. (11)—Back up the case or gear flange solidly around the rivet head and carefully drive out the rivets. (12)—Tap off the ring gear with a soft hammer. (13)—After removing the ring gear, inspect the case flange for gear seat runout, using a dial indicator and turning the case in V-blocks on its bearing hubs. (14)—If the runout is in excess of .002", set the case up in a lathe and true up the gear seat. (15)—Recheck in V-blocks. (16)—Remove burrs at the rivet holes in the case flange. (17)—As the differential pinion shaft was removed to take out the axle shaft, all differential parts are loose and can be removed by hand.

(18)—To remove the drive pinion and propeller shaft, remove the adjusting sleeve lock in the side of the carrier and thread the pinion adjusting sleeve out of the carrier. (19)—Remove the propeller shaft and pinion from the housing.

(20)—To remove the pinion or bearings, remove the nut on the end of the propeller shaft. (21)—Pry up the staked section of the pinion bearing nut at the front of the assembly. (22)—Tighten the nut against the double row bearing which will force against the inner race of the bearing. (23)—If a reasonable amount of pressure does not loosen the pinion, tap the end of the shaft with a brass hammer. (24)—With the pinion removed from the shaft, the single row ball bearing can easily be removed. (25)—Do not drive

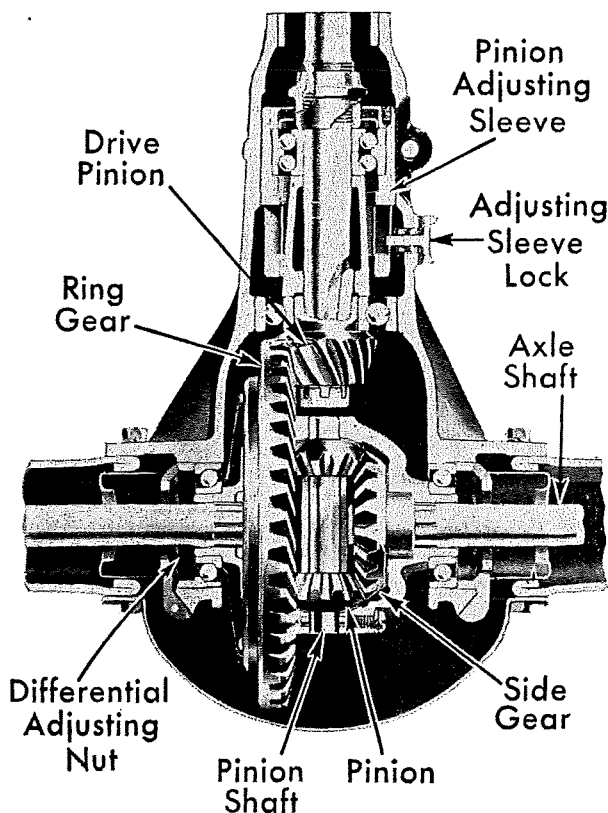


Fig. 147—Group No. 110 Rear Axle

against the outer race of the bearing. (26)—Remove the screw in the front end of the adjusting sleeve and back out the retaining nut. (27)—Jar the bearing sleeve on the bench to remove the double row bearing from the sleeve.

ASSEMBLE

(1)—To assemble, install the double row bearing in the sleeve and tighten the retaining nut against the bearing to eliminate any possibility of end play. (2)—Redrill and tap a new hole for the lock screw in the retaining nut and install it. (3)—Back up the pinion bearing nut about five turns and assemble the double row bearing and sleeve on the pinion shaft. (4)—Next assemble the spacer and pinion with the single row bearing mounted on the hub of the pinion. (5)—Draw the pinion down on the shaft as tight as possible before tightening the pinion shaft bearing nut. (6)—Draw the pinion bearing nut down as tightly as possible and stake it in position. (7)—Then screw the assembly into the carrier assembly.

(8)—If the ring gear was removed from the differential case, bolt the gear to the case, using six $\frac{5}{16}$ " diameter bolts and draw them up securely, leaving a hole open between each bolt for riveting. Use only new rivets that fill the holes completely and that leave

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

approximately $\frac{5}{16}$ " of shank for heading. (9)—Place the gear and case in a riveting fixture and using the proper rivet set, head up opposite rivets. (10)—Start riveting with rivet head on differential flange side. Do not work around the gear in riveting as the gear is liable to be drawn to one side and run eccentric. (11)—Remove the bolts and finish riveting as already described. (12)—The runout should not exceed .006" when checked at the back of the gear.

(13)—Before assembling the differential, examine the side gear bearing surfaces in the differential case and the thrust surfaces on the side and pinion gears. (14)—See that the hubs and splines of these gears are in good condition and that the side gear splines are a good fit on the axle shafts. (15)—Also check the fit of the pinion gears on the pinion shaft. (16)—If any of the parts are worn, they should be replaced. (17)—Press the differential bearing in place. (18)—Locate the differential case in the carrier. (19)—Install the differential bearing caps and adjusting nuts. (20)—Draw up on the adjusting nuts until the marks indicate that the bearings are in their original position. (21)—To adjust the differential bearings, back off the right bearing cap screws $1\frac{1}{2}$ turns and tap the cap lightly with a hammer to free the race and adjusting nut. (22)—Mark the position of both adjusting nuts. (23)—Watch the outer race of the right bearing turn with the adjusting nuts as the nut is slowly backed off and stop when the race stops turning. (24)—Mark this new position of the adjusting nut and return it to its original position. (25)—Repeat, backing off the adjusting nut and again stop when the bearing race stops turning with the nut. This should be the same as before and the number of notches between the original position and the free position of the nut are the "notches tight" of the bearing. The correct adjustment is not less than one nor more than two notches tight. If the bearing race did not turn when backing off the adjusting nut, the bearings have "lapped" free, or one of the bearings has "locked" and turned on the hub of the differential case. (26)—Before investigating further, determine how loose the bearing was by drawing up the adjusting nut until the outer race just starts to turn with the nut. (27)—Equalize the adjustment between the right and the left bearings. (28)—Draw down the cap screws lightly and tap both caps with a hammer to permit seating of the bearings. (29)—Then tighten the cap screws.

(30)—Now check the backlash between the ring gear and the pinion. It should be from .006" to .010". (31)—If it is too great, loosen the right adjusting nut and tighten the left nut one notch. Do this until the backlash is correct. (32)—If the backlash is too small, loosen the left adjusting nut and tighten the right nut. (33)—Check tooth contact and if it is necessary to move the ring gear toward or away from the pinion, turn each adjusting nut the same number of turns in the same direction so that the backlash will not be changed. (34)—If it is necessary to move the pinion toward or away from the ring gear, turn the adjusting sleeve at the pinion front bearing by inserting a suitable tool through the lock screw hole in the side of the

housing. (35)—When the tooth contact is correct, insert the lock screw in the hole to hold the sleeve in its proper position.

(36)—When this is correct, assemble the carrier in the rear axle housing. (37)—A new gasket and lock washers should be used whenever the carrier is removed from the housing. (38)—Pull up the cap screws evenly and securely. Lubricate the hubs of the differential side gears with rear axle lubricant and install them and their thrust washers in the differential case. (39)—Then install the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (40)—Roll the two differential pinions into place, holding the thrust washers at the back of the pinions. (41)—Install the pinion gear shaft and its lock screw. (42)—Install the housing cover, using a new gasket. (43)—Fill the housing to its proper level with the correct lubricant.

GROUP No. 111

Fig. 148

CHEVROLET 1936 PASSENGER CARS AND ALL 1936-39 $\frac{1}{2}$, $\frac{3}{4}$ AND 1 TON TRUCKS

GMC (with spiral bevel) 1937-1938, T-14
1938, T15, T-145; 1939-1940, AC-100, AC-150
PONTIAC 1936

DISASSEMBLE

(1)—Remove the rear axle assembly and the axle shaft as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (2)—Remove the nuts and lock washers which hold the differential carrier to the axle housing and remove the differential carrier housing and torque tube from the rear axle housing. (3)—Place the unit in the vise. (4)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (5)—Remove the differential bearing cap screw locks and screws and lift out the differential assembly.

(6)—To disassemble the differential, remove the differential bearings from the differential case with a bearing puller. (7)—Clean, oil and check the bearings for roughness. The bearings are built with as high as .018" end play, but after they are properly installed and adjusted there is no looseness. (8)—If it is just necessary to replace the bearings, use a suitable driver to replace the bearings. (9)—Check the ring gear for looseness. (10)—If it is necessary to remove the ring gear, use a $\frac{3}{8}$ " drill to remove the rivet heads. Drill from the flange side of the case. Do not cut off the heads of the rivets with a cold chisel as the differential case may be disturbed. (11)—Tap off the ring gear with a soft hammer. (12)—After the ring gear has been removed from the differential case, the case must be checked on V-blocks and with a dial indicator. (13)—First check the ring gear pilot for run-out. This

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

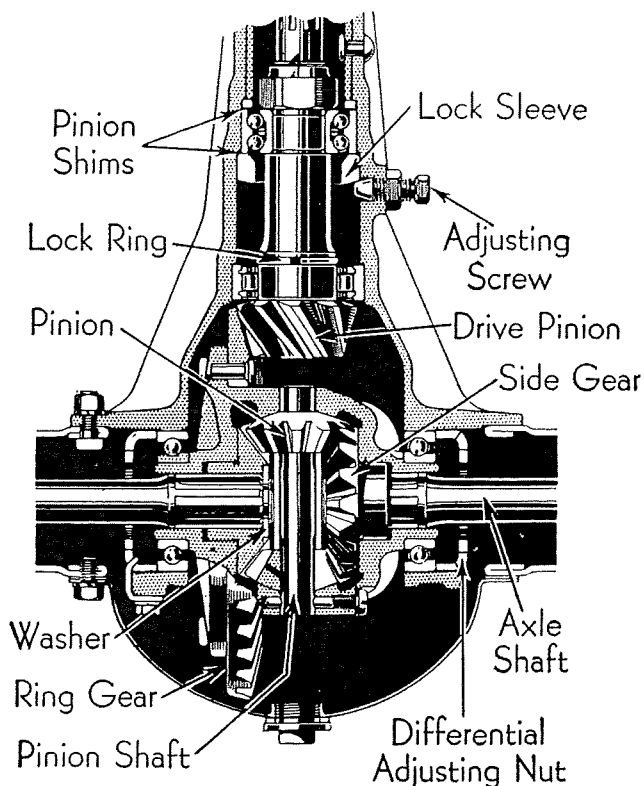


Fig. 148—Group No. 111 Rear Axle

should not exceed .002". (14)—Set case in lathe and true up gear seat. Then check the face on which the ring gear is riveted for runout. This should not exceed .002". (15)—If either of these faces exceed this amount, replacement is the only remedy. (16)—The differential pinion shaft was removed to take out the axle shaft. (17)—All differential parts can be removed by hand. (18)—To remove the drive pinion and propeller shaft, remove the three cap screws with lock nuts on the side of the differential carrier housing. (19)—Remove the propeller shaft and pinion from the housing. (20)—If it will not come out readily, bump its splined end on a wooden block to loosen it. (21)—Remove the shims and spacers from the inside of the propeller shaft housing at the front bearing seat. Keep the shims together so that the original assembly may be maintained. (22)—Inspect the splines for wear or looseness in the universal joint and examine the propeller shaft. (23)—Clean and oil the bearings and check for roughness. (24)—Check the double row ball bearings for end play. (25)—If there is end play in this bearing it should be replaced, as end play will allow the pinion to move in and out of mesh with the ring gear. (26)—Examine the pinion for cracked, chipped or scored teeth. (27)—To disassemble the pinion from the propeller shaft it should be clamped in a vise at the pinion coupling so as not to compress the tube and damage it. (28)—Then raise the lip on the pinion thrust bearing retaining nut and loosen this nut. (29)—Cut off the rivet head which holds the pin-

ion shaft to the coupling and drive out this rivet. (30)—Remove the pinion assembly by driving on the end of the gear with a brass drift or other soft tool to prevent damage to the gear. (31)—Clamp the spline end of the pinion in a vise with soft jaws and remove the pinion bearing lock nut. (32)—Press the double row bearing from the pinion shaft and remove the lock sleeve. (33)—Remove the single row rear bearing by removing the lock ring in front of the bearing and then pressing it off on an arbor press and with press plates.

(34)—After the bearings have been removed from the pinion, they should be cleaned and dried. (35)—After the bearings have been cleaned, they should be oiled and rotated by hand. (36)—The single row bearing should have an end play of .004" to .006".

ASSEMBLE

(1)—To assemble, press the single row bearing on the pinion shaft. (2)—Install the lock sleeve with the tapered side toward the pinion. (3)—Press on the double row bearing. (4)—Install a new lock nut loosely. (5)—Press the pinion shaft into the propeller shaft so that the rivet holes in both parts are in alignment. (6)—Install a pin in the hole and rivet both ends. (7)—Tighten the bearing lock nut and lock it in the keyway of the pinion shaft. (8)—When this operation is done, the complete assembly should be mounted in V blocks, one block at the rear bearing and the other block at the ground diameter which is back of the spline on the front end of the propeller shaft. (9)—The maximum indicator runout to which this assembly should be straightened is .002" at the front double row bearing; .010" at the part of the propeller shaft in front of rear splines; .015" in the section at the center of the propeller shaft and .005" at the extreme front end of the propeller shaft. (10)—Insert the shims in the torque tube. (11)—Install the pinion and propeller shaft in the differential housing. (12)—Insert the three pointed lock screws in the side of the housing and draw them down evenly and securely. (13)—Then tighten the lock nuts. (14)—Bolt the gear to the case, using four bolts and draw them up securely, leaving a hole open between each bolt hole for riveting. (15)—Use only new rivets that fill the hole completely and that leave approximately $\frac{5}{16}$ " of shank for heading. (16)—The rivet heads should be formed on the ring gear flange and not on the back of the differential case flange. (17)—Place the gear and case in a riveting fixture and using the proper rivet set, head up opposite rivets. Do not work around the gear in riveting as the gear is liable to be drawn to one side and run eccentric. (18)—Remove the bolts and finish riveting as already described. The runout should not exceed .007" when checked at the back of the gear. (19)—Before assembling the differential, examine the side gear bearing surfaces in the differential case and the thrust surfaces on the side and pinion gears. (20)—See that the hubs and splines of these gears are in good condition and that the side gear splines are a good fit on the axle shafts. (21)—Also check the fit of the pinion gears on the pinion shaft. (22)—If any

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

of the parts are worn, they should be replaced. (23)—Press the differential bearing in place with the side marked "thrust here" toward the case. (24)—Locate the differential case in the carrier. (25)—Install the differential bearing caps and adjusting nuts. (26)—Draw up on the adjusting nuts until the marks indicate that the bearings are in their original position. (27)—Tighten the cap screws until the lock washers are flat. (28)—Back off the right adjusting nut. (29)—Tighten the left adjusting nut until all lash is removed on the high spot and the nut is in its locking position, then back off the left nut one notch. (30)—Tighten the right nut snug and then tighten it from 1 to 1½ notches more to a locking position. (31)—Check for backlash. (32)—This should be .008". (33)—If it is more than this, loosen the right nut one notch and tighten the left nut one notch. (34)—If it is less than this, loosen the left nut one notch and tighten the right nut one notch. (35)—Tighten the cap screws and recheck the ring gear and pinion backlash. (36)—Assemble the adjusting nut locks. If it is necessary to move the pinion to secure proper tooth contact, it will be necessary to disassemble the rear axle and change the shims at the pinion front bearing. (37)—Now tighten the bearing cap lock screws securely and recheck the backlash. (38)—When correct, install the adjusting nut locks and lock the adjustment. (39)—After this is correct, assemble the carrier in the rear axle housing. (40)—A new gasket and lock washers should be used whenever the carrier is removed from the housing. (41)—Pull up the cap screws evenly and securely. (42)—Lubricate the hubs of the differential side gears with rear axle lubricant and install them in the differential case. (43)—Then install the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (44)—Spread the ends of the axle shafts to make sure that the shafts, locks and differential side gears are in positive contact. (45)—Roll the two differential pinions into place and install the axle shaft spacer, pinion gear shaft and lock screw. (46)—Then check the clearance between the end of the axle shaft and the spacer as described in the AXLE SHAFT chapter. (47)—Install the housing cover, using a new gasket and fill the housing to its proper level with the correct lubricant.

GROUP No. 112

Fig. 149

CHEVROLET 1937-42 ALL PASSENGER CARS

GMC (with hypoid gear)

1940—AC-100, AF-100, AC-150, AF-150;

1941—CC-100, CC-150

DISASSEMBLE

(1)—Remove the rear axle assembly and the axle shaft as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (2)—Remove the nuts and

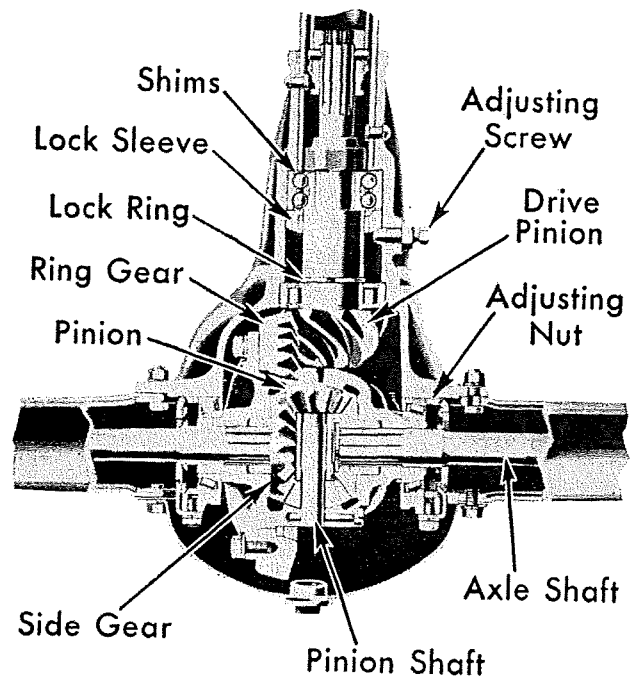


Fig. 149—Group No. 112 Rear Axle

the lock washers which hold the differential carrier to the axle housing and remove the differential carrier housing and torque tube from the rear axle housing. (3)—Place the unit in a vise. (4)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (5)—Remove the differential bearing cap screw locks and screws and lift out the differential assembly.

(6)—To disassemble the differential, remove the differential bearing cones from the differential case with a bearing puller. They are a press fit on the hubs of each side of the differential case. (7)—Clean, oil and check the bearings for roughness. (8)—If it is just necessary to replace the bearings, place the new bearings on the hubs with the thick side of the cone toward the case and drive them in place with a suitable tool. (9)—Remove the bolts which hold the ring gear to the differential case and tap the ring gear off with a soft hammer. (10)—Place the differential case in V blocks and check the runout of both the ring gear pilot and the case flange. (11)—Neither of these runouts should exceed .001". (12)—As the differential pinion shaft was removed to remove the axle shaft locks, all the differential parts can now be removed by hand.

(13)—To remove the drive pinion and propeller shaft, remove the three cap screws with lock nuts on the side of the differential carrier housing. (14)—Let the assembly drop so that the spline end of the propeller shaft will strike on a wooden block or wooden

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

floor and the pinion shaft will slide out. (15)—Remove the shims from the inside of the propeller shaft housing. (16)—Keep the shims together so that the original assembly may be maintained when the parts are assembled. (17)—Inspect the splines for wear or looseness in the universal joint and also inspect the shaft at the propeller shaft bushing location. (18)—Clean and oil the bearings and check them for roughness. (19)—Check the double row ball bearings for end play. (20)—If there is end play in this bearing it should be replaced as end play will allow the pinion to move in and out of mesh with the ring gear. (21)—Examine the pinion for cracked, chipped or scored teeth.

(22)—To disassemble the pinion from the propeller shaft, first drill the end of the rivet to clear the countersink into which it is upset, being careful to properly center the rivet with a center punch. (23)—Then drive out the rivet. (24)—Loosen the pinion bearing lock nut and then disassemble the pinion from the propeller shaft. (25)—Remove the front pinion bearing lock nut and press the pinion bearing from the pinion. (26)—Remove the rear pinion bearing lock ring and remove the rear bearing.

ASSEMBLE

(1)—To assemble, install the rear pinion bearing on the pinion shaft and install the lock ring in its groove in the shaft. (2)—Install the lock sleeve with its beveled side toward the pinion. (3)—Press the front double row bearing on the pinion shaft and install the bearing lock nut. (4)—The pinion assembly may now be assembled to the propeller shaft by pressing the splined end into the coupling on the end of the propeller shaft so that the rivet hole in the pinion shaft lines up with the hole in the propeller shaft. (5)—Insert a new rivet in this hole and rivet over both ends. (6)—Tighten the bearing lock nut and lock it in the milled slot in the pinion shaft.

(7)—Assemble the same thickness of shims in the counterbore of the propeller shaft housing that were removed from it, making sure that if the original ring gear and pinion are to be used, the shims are flat in the counterbore and are not cocked. (8)—The total thickness of shims will be found to be from .030" to .036" and usually .033". (9)—Whenever a new ring gear and pinion are installed, one .015" shim and one .018" shim should be used. (10)—Assemble the propeller shaft assembly, driving it down until the bearings are seated in the housing. (11)—Drive it on by using a drift in the $\frac{7}{8}$ " hole in the pinion and not on the pinion teeth. (12)—Check through the bearing lock screw holes to make sure that the lock sleeve is in the correct position, up against the back of the front pinion bearing. (13)—Install the three tapered lock screws and draw them down evenly and tightly. (14)—Tighten the lock screw nuts.

(15)—To replace the ring gear on the differential case use five guide pins made by cutting the heads from $\frac{3}{8}$ "-24 cap screws about 1½" long. (16)—Slots

should be cut in the heads of these guide pins so that they may be easily removed. (17)—Install these guide pins in alternate holes in the ring gear and slip the ring gear over the pilot diameter of the case, making sure that the back face of the ring gear and the face of the case are free from dirt and burrs. (18)—Install every other ring gear bolt and draw them up evenly and snugly so that the ring gear face is flush with the face of the case. (19)—Remove the guide pins and install the remaining bolts. (20)—Tighten all ring gear bolts. (21)—New lock washers should be used under the head of each bolt. (22)—With the assembly mounted in V-blocks, check the runout of the back face of the ring gear with a dial indicator. This runout must not exceed .004".

(23)—Examine both differential side gear bearing surfaces in the differential case; also the backs or thrust surfaces of these gears and the differential pinion gears. (24)—Check both differential side bearings for roughness after they have been thoroughly cleaned and oiled. (25)—Inspect the differential side gears for scored hubs or thrust surfaces. (26)—Examine the internal splines and check their fit on an axle shaft. (27)—Inspect the thrust surfaces on the differential pinion gears and check their fit on the pinion shaft. (28)—To replace the differential bearings, place them on the hubs with the thick side of the inner race toward the case and drive them in place with a suitable tool. (29)—Locate the differential case in the carrier. (30)—Install the differential bearing caps and adjusting nuts. (31)—Draw up on the adjusting nuts until the marks indicate that the bearings are in their original position. (32)—Tighten the cap screws until the lock washers just flatten out.

(33)—To check the adjustment, loosen the right adjusting nut and tighten the left nut, while at the same time turning the ring gear. (34)—Continue tightening the left nut until all lash is removed, then back off the left nut one notch. (35)—Tighten the right adjusting nut snugly, when the nut comes to a definite stop. (36)—Then tighten the right nut from a minimum of 1 to a maximum of 2 notches more, to a locking position. (37)—Mount a dial gauge on the carrier and check the backlash between the ring gear and pinion. This should be from .005" to .007". (38)—If the backlash is more than the above, loosen the right adjusting nut 1 notch and tighten the left nut 1 notch. (39)—If the backlash is less than specified, loosen the left adjusting nut 1 notch and tighten the right nut 1 notch. (40)—Tighten the bearing cap bolts securely. (41)—Then recheck the backlash. (42)—Install both adjusting nut locks.

If it is necessary to remove the pinion to secure proper tooth contact, it will be necessary to disassemble the rear axle and change the number of shims at the pinion front bearing. (43)—When the adjustments are correct, assemble the carrier in the rear axle housing. A new gasket and lock washers should be used whenever the carrier is removed from the housing. (44)—Pull up the cap screws evenly and securely.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

(45)—Lubricate the hubs of the differential side gears with hypoid gear lubricant and install them in the differential case. (46)—Then install the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (47)—Spread the ends of the axle shafts to make sure that the shafts, locks and differential side gears are in positive contact. (48)—Roll the two differential pinions into place and install the axle shaft spacer, pinion gear shaft and lock screw. (49)—Then check the clearance between the end of the axle shaft and the spacer as described in the AXLE SHAFT chapter. (50)—Install the housing cover, using a new cork gasket and fill the housing to its proper level with the correct grade of lubricant.

GROUP No. 113

Fig. 150

OLDSMOBILE 1936

DISASSEMBLE

(1)—Drain the oil from the differential by removing the drain plug in the cover. (2)—Remove the cover from the rear of the housing. (3)—Remove the axle shafts as described in the AXLE SHAFT, REMOVE AND REPLACE chapter. (4)—Remove the universal joint flange bolts at the rear universal joint and drop the propeller shaft. (5)—Remove the cap screws which hold the differential carrier to the axle housing and lift out the differential carrier. (6)—Mount the carrier on a bench or in a vise. (7)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be disassembled with approximately the same drive gear adjustment. (8)—Remove the differential bearing cap screws and lift off the caps. (9)—Lift out the differential and ring gear assembly. (10)—With a puller, remove the differential bearings. (11)—If it is necessary to remove the ring gear, remove the bolts which hold the ring gear to the differential case. (12)—Press the ring gear off the differential case. (13)—Remove the differential pinion shaft lock screw and push out the differential pinion shaft. (14)—All the differential parts will then be loose and can be removed by hand.

NOTE—The drive pinion and bearing can be removed from the carrier without removing the differential from the car, after the universal joint has been disconnected as described above. (15)—Remove the six cap screws which hold the pinion bearing retaining flange to the differential housing. (16)—Remove the pinion shaft and bearing assembly by tapping the companion flange toward the front of the car. It is a slip fit in the housing. Be careful not to damage the shims since if they are not damaged, the original shims may be replaced. If the shims are damaged, replace them with shims of the same thickness. (17)—Hold the companion flange in a vise and remove the cotter pin, retaining nut and companion flange. (18)—Remove the

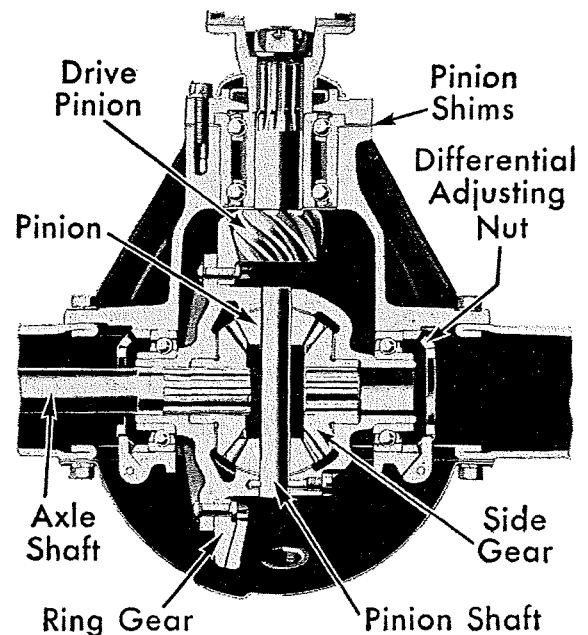


Fig. 150—Group No. 113 Rear Axle

bearing from the pinion shaft by means of an arbor press and a piece of 3" standard wrought iron pipe of the following dimensions: Inside diameter— $3\frac{1}{16}$ ", outside diameter— $3\frac{1}{2}$ " and length— $4\frac{3}{4}$ ". Do not use a hammer or drift on the bearings.

ASSEMBLE

NOTE—The double row pinion bearing is built with no looseness and if when examined, there is looseness or endwise movement between the race and the cone the bearing must be replaced. The differential bearings are built with as high as .020" end play and are loose until pulled into position by the adjusting nut. These bearings should not be rejected unless the bearing shows chipped balls or races or has more than .030" end play. The gear and pinion teeth should also be checked for worn or broken teeth.

(1)—To assemble, press the pinion bearing on the pinion shaft by applying pressure to the inner race of the bearing but never apply pressure to the outer race. (2)—Replace the bearing retaining flange and the universal joint flange on the pinion shaft. (3)—Tighten the universal joint flange nut and lock it in place. (4)—Assemble the original shims or shims of the original thickness at the front end of the housing and slide the pinion and bearing assembly in the housing. (5)—Tighten the screws which hold the bearing retainer to the housing. (6)—Install the differential bearings on the case with the numbers of the inner race next to the shoulder on the case. (7)—Install the differential side gear thrust washers and side gear, either face of the washer may be used next to the gear hub. (8)—Put the differential intermediate gears in mesh with the differential side gears holding the thrust washers on

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

back of the gear, then rotate the differential side gears until the holes through the center of the intermediate gears align with the hole for the shaft in the differential. (9)—Push, do not drive the intermediate gear shaft in place so that the hole in the shaft for the lock screws aligns with the hole in the differential. (10)—Install the intermediate gear shaft lock screw, with the lock washer under the head of the screw. (11)—Replace the differential assembly in the carrier. (12)—Put the differential bearing caps and nuts in place and turn the nuts until the marks made on the caps and nuts indicate that the parts are in their original position, and tighten the caps. (13)—Then back off each bearing cap bolt a half turn. (14)—Back off the right adjusting nut 4 turns. (15)—Tighten the left nut against the bearing race, removing all lash between the ring gear and pinion. (16)—Then back the nut off 4 notches, leaving the slot in the adjusting nut in line with the lock slot in the bearing caps. (17)—Tighten the right adjusting nut, watching the race of the bearing. (18)—When the bearing starts to turn, indicating tension on the bearing, continue to tighten the nut 3 more notches. (19)—Then back off the nut until the bearing race stops turning. (20)—Again tighten the nut until the race starts to turn. (21)—Then tighten the nut $1\frac{1}{2}$ to 2 notches to make a slot in the nut line up with the lock slot in the bearing cap. (22)—Tighten the bearing cap bolts. (23)—Clamp an indicator to the differential carrier and check the backlash which should be .004" to .008". (24)—If necessary, loosen the bearing cap bolts and adjust the bearing nuts to obtain the correct lash. Always turn both nuts an equal number of notches. (25)—Tighten the bearing caps securely and install the adjusting nut locks and cap screws. (26)—Check the tooth contact and if it is necessary to move the ring gear toward or away from the pinion, turn both differential bearing adjusting nuts an equal number of turns in the same direction. (27)—If it is necessary to move the pinion away from or toward the ring gear, the shims at the rear of the pinion double row ball bearing must be changed. (28)—After this is correct, assemble the carrier in the rear axle housing. (29)—A new gasket and lock washers should be used whenever the carrier is removed from the housing. (30)—Pull up the cap screws evenly and securely. (31)—Assemble the axle shafts as described under AXLE SHAFT, REMOVE AND REPLACE chapter. (32)—Fill the housing to the level of the filler plug hole with the specified grade and type of lubricant. (33)—Attach the propeller shaft to the rear universal joint flange, using new cap screw locks.

GROUP No. 114

Fig. 151—Fig. 152

FORD TRUCKS AND BUSES WITH HOTCHKISS DRIVE 1940-42

DISASSEMBLE

(1)—Disconnect the propeller shaft at the pinion shaft end and use a suitable puller to remove the flange from the pinion shaft. (2)—Unscrew the axle shaft flange nuts and pull out the shafts, being careful not

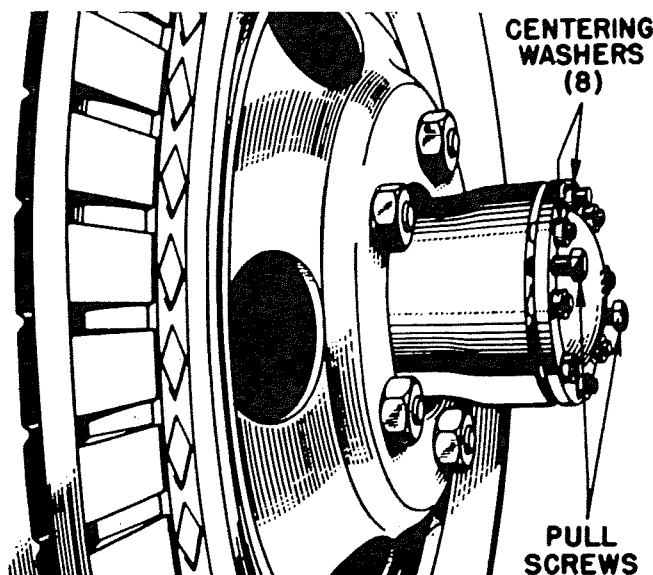


Fig. 151—Group No. 114 Removing Axle Shaft from Ford Truck

to lose the tapered dowels on the flange studs. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which, the hubs may be removed. (4)—Remove the cap screws which retain the pinion bearing cage in the differential housing and withdraw the drive pinion assembly. (5)—Remove the oil seal and cover assembly. (6)—Straighten the tabs on the pinion bearing adjusting nut washer and remove the lock nut, washer, adjusting nut and spacer. (7)—Remove the pinion bearing cage from the pinion shaft, bringing the front bearing along with it. (8)—Use a suitable puller to remove the pinion bearing cups or drive them out with a brass drift.

NOTE—When installing the cups, be sure to drive them in straight, otherwise a sprung bearing cage will likely result; be sure also, that they are pressed down firmly against the shoulder in the pinion cage. (9)—Remove the bolts which fasten the two halves of the axle housing together and separate the housing. (10)—Mark both halves of the differential case so that when assembled, the original position is maintained, then

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

unscrew the bolts which attach the two halves of the case, after which, the case may be separated and all the differential parts removed.

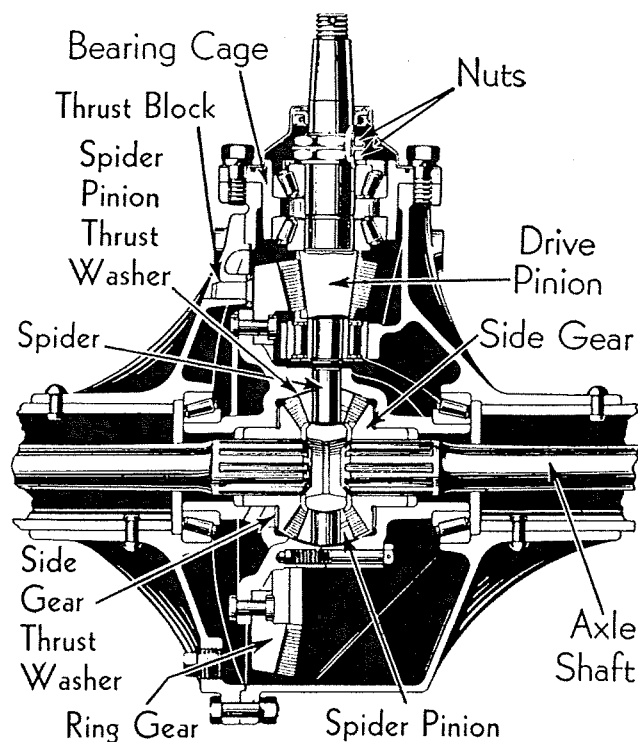


Fig. 152—Group No. 114 Rear Axle

INSPECTION

(1)—Clean the housings thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. If the differential bearing cups are cracked or otherwise damaged, use a suitable puller to remove them from the housing. (2)—When bronze thrust washers are used behind the differential side gears and pinions, they should be replaced if any evidence of wear is apparent. (3)—Drive the thrust block stud from the left hand housing and remove the block.

NOTE—If the thrust block shows any indication of wear, it should be replaced as it takes the excessive side thrust on the drive gear, thus relieving the strain on the differential case and side bearings. (4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts, being sure to assemble the tapered dowels in the stud ends, and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout is in excess of $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure that the axle shafts are not sprung, the housings may be checked by measuring the distance from the axle shaft splines to the outer edge of the axle housing; measurements should be taken at several

points around the housing, and if the variation is more than $\frac{1}{32}$ " at any point, the housing is sprung and should be replaced.

NOTE—Shims should not be used at the pinion bearing cage when new gears are installed except in rare instances when new gears develop a noise after having been in service for some time. If a noise develops, install a shim of from .003" to .005" thickness between the pinion bearing cage and the axle housing.

ASSEMBLE

(1)—Fasten the drive pinion in a vise and assemble the bearings and pinion shaft to the cage, being sure to lubricate the bearings thoroughly before installing. (2)—Place the spacer on the shaft and run the adjusting nut up all the way to be sure the bearings are properly seated, then back off the nut just enough to permit the cage to be turned, yet not enough to allow it to spin. (3)—Install a new lock washer on the shaft with its inner prong seated in the pinion shaft slot, then run the lock nut up tight, being careful not to change the adjustment. If necessary, back off the adjusting nut slightly. (4)—After adjusting the bearings satisfactorily, bend one of the tabs of the lock washer over the adjusting nut and another over the lock nut to hold the nuts securely in place. (5)—Lubricate the differential spider, pinions, side gears and bronze thrust washers (if used) and assemble them in the differential case, lining up the marks on both halves of the case before installing the cap screws; after tightening the cap screws securely, thread locking wire through all the screw heads. (6)—Lubricate the differential side bearings and install them in the housing. (7)—Install a new thrust block, being sure the locking pin is a tight fit in its hole. (8)—Install the differential assembly in the left hand housing. Lubricate the pinion shaft rear bearing and place it in position in the right hand housing. (9)—Install the drive pinion assembly in the housing, replace the oil seal and cover, fastening the assembly to the housing securely. (10)—Bolt the two halves of the rear axle housing securely together.

NOTE—No gasket is used between the housings and no attempt should be made to alter the backlash between the drive gear and pinion by the use of a gasket, or by machining the face of the axle housing. (11)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (12)—Adjust the bearings by tightening the bearing adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (13)—Install the axle shafts, being sure that the tapered dowels are in place on all studs, then tighten the stud nuts securely.

NOTE—When the flange nuts are drawn up tight, there should always be a slight clearance between the lock washer and the flange. No clearance at this point indicates excessive wear on the studs, flange holes or tapered dowels. (14)—Complete the assembly by installing the universal flange and propeller shaft.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

GROUP No. 115

Fig. 153

FORD TRUCKS AND BUSES WITH TORQUE TUBE DRIVE 1934-39

DISASSEMBLE

(1)—With the axle housing and propeller shaft removed from the car, remove the bolts and lock washers holding the torque tube to the axle housing. (2)—With a suitable puller, remove the torque tube and propeller shaft from the housing and drive pinion shaft. (3)—The drive pinion, bearings and bearing sleeve can be removed from the housing. (4)—Straighten the pinion nut lock washer and remove the lock nut, washer, adjusting nut and bearing thrust washer. (5)—Press the pinion shaft out of the bearings. (6)—The bearing cups can be removed from the sleeve with a puller. (7)—If it is necessary to replace the

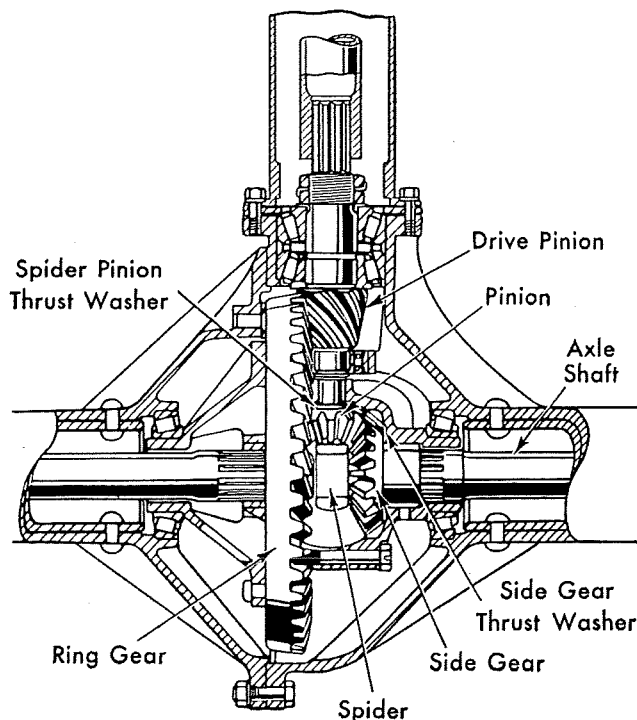


Fig. 153—Group No. 115 Rear Axle

pinion or the rear bearing, use a puller to remove the rear bearing cone. (8)—Remove the axle shaft flange nuts and pull out the shafts, being careful not to lose the tapered dowels on the flange studs. (9)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts. (10)—The wheel hubs can now be removed. (11)—Remove the bolts which fasten the two halves of the axle housing together and separate the housing. (12)—Mark both halves of the differential case so that when assembled,

the original position is maintained, then unscrew the bolts which attach the two halves of the case, after which, the case may be separated and all the differential parts removed.

INSPECTION

(1)—Clean the housings thoroughly and inspect all gears and bearings, for wear, cracks, pits or score marks. If the differential bearing cups are cracked or otherwise damaged, use a suitable puller to remove them from the housing. (2)—When bronze thrust washers are used behind the differential side gears and pinions, they should be replaced if any evidence of wear is apparent. (3)—Drive the thrust block stud from the left hand housing and remove the block.

NOTE—If the thrust block shows any indication of wear, it should be replaced as it takes the excessive side thrust on the drive gear, thus relieving the strain on the differential case and side bearings. (4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts, being sure to assemble the tapered dowels in the stud ends, and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout is in excess of $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure that the axle shafts are not sprung, the housings may be checked by measuring the distance from the axle shaft splines to the outer edge of the axle housing; measurements should be taken at several points around the housing, and if the variation is more than $\frac{1}{32}$ " at any point, the housing is sprung and should be replaced.

NOTE—Shims should not be used at the pinion bearing cage when new gears are installed except in rare instances when new gears develop a noise after having been in service for some time. If a noise develops, install a shim of from .003" to .005" thickness between the pinion bearing cage and the axle housing.

ASSEMBLE

(1)—Fasten the drive pinion in a vise and assemble the bearings and pinion shaft to the cage, being sure to lubricate the bearings thoroughly before installing.

NOTE—When installing the cups, be sure to drive them in straight, otherwise a sprung bearing cage will likely result; be sure also, that they are pressed down firmly against the shoulder in the pinion cage.

(2)—Place the spacer on the shaft and run the adjusting nut up all the way to be sure the bearings are properly seated, then back off the nut just enough to permit the cage to be turned, yet not enough to allow it to spin. (3)—Install a new lock washer on the shaft with its inner prong seated in the pinion shaft slot, then run the lock nut up tight, being careful not to change the adjustment. If necessary, back off the

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

adjusting nut slightly. (4)—After adjusting the bearings satisfactorily, bend one of the tabs of the lock washer over the adjusting nut and another over the lock nut to hold the nuts securely in place. (5)—Lubricate the differential spider, pinions, side gears and thrust washers and assemble them in the differential case, lining up the marks on both halves of the case before installing the cap screws; after tightening the cap screws securely, thread locking wire through all the screw heads. (6)—Lubricate the differential side bearings and install them in the housing. (7)—Install a new thrust block, being sure the locking pin is a tight fit in its hole. (8)—Install the differential assembly in the left hand housing. Lubricate the pinion shaft rear bearing and place it in position in the right hand housing. (9)—Install the drive pinion assembly in the housing. (10)—Slide the propeller shaft on the pinion shaft and replace the torque tube. (11)—Fasten the assembly to the housing securely. (12)—Bolt the two halves of the rear axle housing securely together with a gasket between them.

NOTE—No attempt should be made to alter the backlash between the drive gear and pinion with the gasket, or by machining the face of the axle housing. (13)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (14)—Adjust the bearings by tightening the bearing adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (15)—Install the axle shafts, being sure that the tapered dowels are in place on all studs, then tighten the stud nuts securely.

NOTE—When the flange nuts are drawn up tight, there should always be a slight clearance between the lock washer and the flange. No clearance at this point indicates excessive wear on the studs, flange holes or tapered dowels.

GROUP No. 116

Figs. 154, 155

TIMKEN-SPIRAL BEVEL GEARS SERIES 53000, 54000, 56000, 58000

DISASSEMBLE

NOTE—The drive pinion assembly can be removed without disturbing the differential assembly on series 53000 and 54000. However, on the 56000 and 58000 series, the differential assembly will first have to be removed before the drive pinion can be removed.

(1)—Disconnect the propeller shaft flange from the pinion shaft flange. NOTE—Mark the flanges so they may be assembled in the original position. (2)—Unscrew the axle shaft flange nuts and pull out the shafts, being careful not to lose the tapered dowels on the flange studs. (3)—Straighten the tabs on the wheel

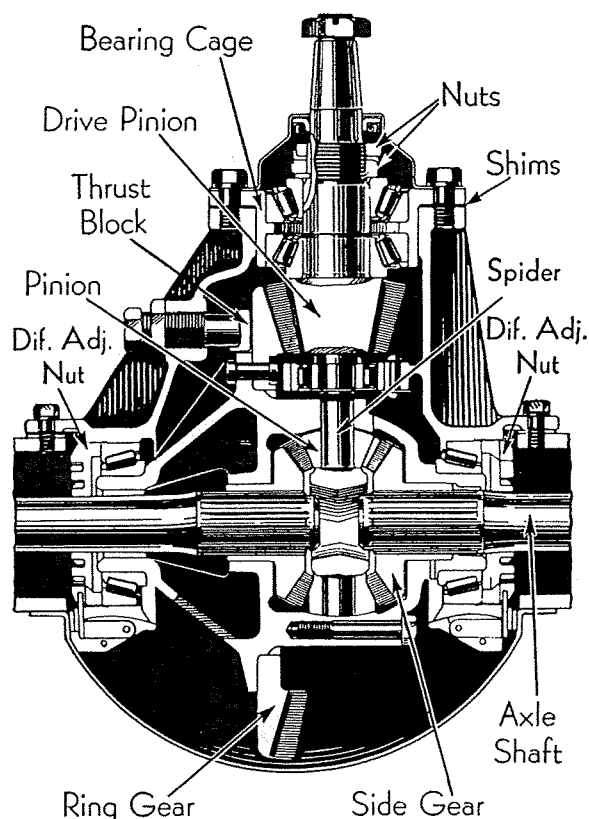


Fig. 154—Group No. 116 Timken 54000

bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which, the hubs may be removed. (4)—Remove the cap screws which fasten the differential carrier and back inspection cover (if equipped) to the axle housing and remove the carrier assembly. (5)—Back out the thrust block adjusting screw to allow the ring gear to clear the thrust block when removing the differential assembly. (6)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembling, the approximate adjustment will be readily obtained, then remove the bearing caps.

NOTE—If the original bearing adjustment is to be retained, remove the left hand bearing cap only, leaving the right one undisturbed. Then shift the differential case over to the left side until it can clear the right hand bearing cap and pinion shaft rear bearing support. (7)—Mark both halves of the differential case so that when assembled, the original position is maintained, then unscrew the nuts or cap screws which attach both halves of the case, after which, the case may be separated and all the differential parts removed. (8)—If the ring gear is to be replaced, use a drill which is smaller than the diameter of the rivet head and drill the rivets from the differential case side, after which, punch out the rivets. (9)—Remove the cap screws which retain the pinion bearing cage in the

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

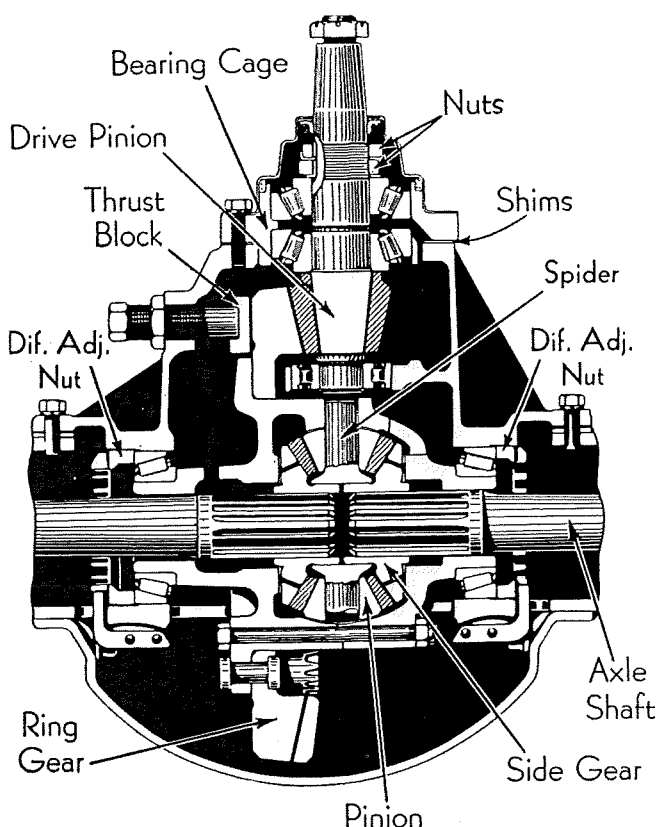


Fig. 155—Group No. 116 Timken 56000

carrier and withdraw the drive pinion assembly. (10)—Remove the oil seal and cover assembly. (11)—Straighten the tabs on the pinion bearing adjusting nut washer and remove the lock nut, washer, adjusting nut and spacer washer. (12)—Remove the pinion bearing cage from the pinion shaft, bringing the front bearing along with it. (13)—Use a suitable puller to remove the pinion bearing cups or drive them out with a brass drift.

NOTE—When installing the cups, be sure to drive them in straight, otherwise a sprung bearing case will likely result; be sure also, that they are pressed down firmly against the shoulders in the pinion cage.

CAUTION—When the pinion assembly is removed from the carrier, be sure to collect any shims which may be assembled between the cage and the housing, noting the quantity and thickness in order to facilitate adjustment when assembling.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show any evidence of wear, they should be replaced. (3)—The thrust block is used to take any excessive side thrust on the

ring gear, and when assembly is completed, the adjusting screw should be turned in or out as required to obtain approximately .015" clearance. (4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts, being sure to assemble the tapered dowels in the stud ends, and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles". If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should not be more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts. (6)—Check the differential case flange for runout by bolting the two halves of the case together and mount the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced. (7)—After the ring gear is attached to the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange. (8)—If new gears are being installed, do not use any shims between the pinion bearing cage and the housing. If the old gears are again used, replace the original quantity of shims as were removed and if it is necessary to move the pinion away from the ring gear to obtain proper tooth contact, shims of several thicknesses are available to obtain the desired result. Similarly, if it is necessary to move the pinion toward the ring gear, remove the necessary thicknesses of shims.

ASSEMBLE

(1)—Fasten the drive pinion in a vise and assemble the bearings and pinion shaft to the cage, being sure to lubricate the bearings thoroughly before installing. (2)—Place the spacer washer on the shaft and run the adjusting nut up all the way to be sure the bearings are properly seated, then back off the nut just enough to permit the cage to be turned, yet not enough to allow it to spin. (3)—Install a new lock washer on the shaft then run the lock nut up tight, being careful not to change the adjustment. If necessary, back off the adjusting nut slightly. (4)—After adjusting the bearings satisfactorily, bend one of the tabs of the lock washer over the adjusting nut and another over the lock nut to hold the nuts securely in place. (5)—Assemble the drive pinion assembly in the carrier, replacing the original quantity of shims. (6)—Lubricate the differential spider, pinions, side gears and thrust washers and assemble them in the differential case, lining

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

up the marks on both halves of the case before installing the cap screws; after tightening the cap screws securely, thread locking wire through all the screw or bolt heads. (7)—Locate the differential case in the carrier and install the bearing caps and adjusting nuts, tightening the cap screws until the lock washers just flatten out.

NOTE—If new parts were installed or an adjustment is necessary, the adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. Then back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cup. (8)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (9)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. (10)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .005" to .010". If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. Now tighten the bearing cap lock screws securely and recheck the lash. When correct, install the adjusting nut locks and lock the adjustment.

NOTE—The endwise adjustment of the drive pinion is controlled by the shims between the bearing cage flange and the housing. These shims are available in several thicknesses, and if an adjustment is necessary, the bearing cage must be removed. In order not to disturb the ring gear adjustment, the differential assembly can be swung out to permit the pinion to be removed without disturbing the right adjusting nut, as already mentioned in the disassembly chapter. (11)—Screw the thrust block adjusting screw partly into the carrier. (12)—Lubricate the thrust block and hold it in place on the ring gear. (13)—Turn the adjusting screw up tight to permit the block to seat on the end of the screw. (14)—Continue turning the screw until the block contacts the ring gear, then back off the screw from 1/6 to 1/4 turn and tighten the lock nut. (15)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (16)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (17)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (18)—Install the axle shafts, being sure that the tapered dowels are in place on all studs, then tighten the stud nuts securely.

NOTE—When the flange nuts are drawn up tight, there should always be a slight clearance between the lock washer and the flange. No clearance at this point indicates excessive wear on the studs, flange holes or tapered dowels. (19)—Complete the assembly by

attaching the propeller shaft flange to the pinion shaft flange, lining up the marks which were made before disassembly.

GROUP No. 117

Fig. 156

GMC, Series F-23H, F-33, F-33H, T-33, T33H
AC-550, 600, 650; AF-550, 600, 650

DISASSEMBLE

(1)—Disconnect the propeller shaft flange from the pinion shaft flange. NOTE—Mark the flanges so they can be assembled in the original position. (2)—Unscrew the axle shaft flange nuts and pull out the shafts, being

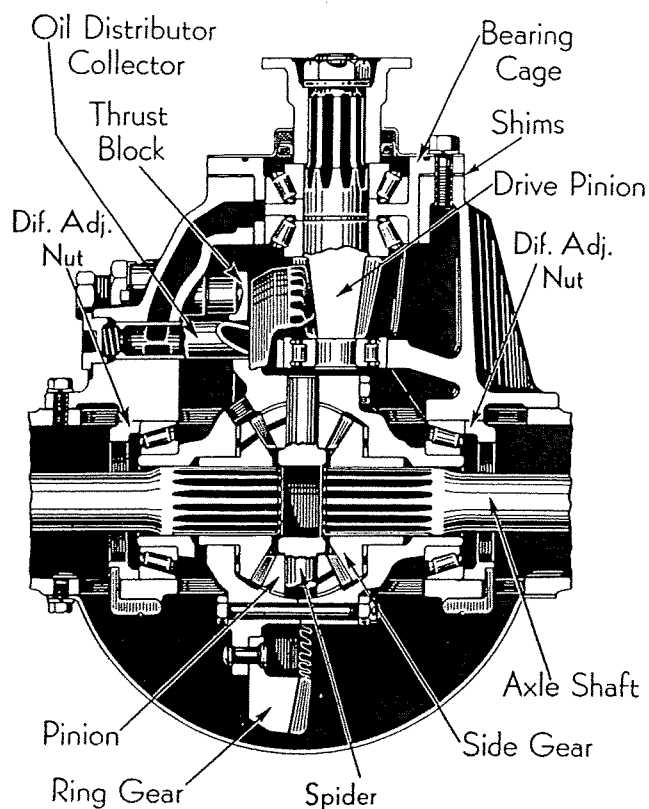


Fig. 156—Group No. 117 Rear Axle

careful not to lose the tapered dowels on the flange studs. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which, the hubs may be removed. (4)—Take off the differential inspection cover. (5)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly. (6)—Take out the oil distributor collector from the carrier.

NOTE—The collector is held by a screw which

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

extends through the carrier and into the collector and can be removed after first unscrewing the threaded plug on some units, or by removing the plate and cap screws on other units. (7)—Back out the thrust block adjusting screw to allow the drive gear to clear the thrust block when removing the differential assembly. (8)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembling, the approximate adjustment will be readily obtained, then remove the bearing caps. NOTE—If the original bearing adjustment is to be retained, remove the left hand bearing cap only, leaving the right one undisturbed. Then shift the differential case assembly over to the left side until it can clear the right hand cap and the pinion shaft rear bearing support. (9)—Mark both halves of the differential case so that when assembled, the original position is maintained, then unscrew the nuts or cap screws which attach both halves of the case, after which, the case may be separated and all the differential parts removed. (10)—If the ring gear is to be replaced, use a drill which is smaller than the diameter of the rivet head and drill the rivet from the ring gear side, after which, punch out the rivets. (11)—Pull the drive pinion and bearing cage assembly out of the carrier. (12)—Clamp the pinion or universal flange in a vise and remove the flange retaining nut, after which, the flange, oil seal cover, front roller bearing, spacer and bearing cage may be removed.

NOTE—Collect the shims under the bearing cage, noting the quantity and thickness in order to facilitate adjustment when assembling. (13)—The rear roller bearing may now be removed from the pinion shaft.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced. (3)—The thrust block is used to take any excessive side thrust on the ring gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain from .015" to .020" clearance. (4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts, being sure to assemble the tapered dowels in the stud ends, and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should not be more than $\frac{1}{32}$ "; if more than this amount,

the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts. (6)—Check the differential case flange for runout by bolting the two halves of the case together and mount the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced. (7)—After the ring gear is attached to the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. If within the specified limits, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it is an indication that the ring gear is not properly mounted on the flange.

ASSEMBLE

(1)—Press the rear tapered bearing on the pinion shaft and install the bearing spacer. (2)—Slip the bearing cage on the shaft and assemble the front tapered bearing in place. (3)—Install a new oil seal in the cover and place the seal and cover assembly over the universal flange hub, after which, install the flange on the pinion shaft, fastening the retaining nut securely. (4)—When properly adjusted, the pinion bearing cage should turn freely but not spin on the shaft.

NOTE—If the cage turns too freely, or if end play is evident, it can be eliminated by the use of a different thickness spacer between the bearings. These spacers are available in thickness steps of .003". It is recommended that a dial indicator be used to determine the correct spacer to use. Be sure to lubricate the bearings thoroughly before assembling the pinion. (5)—Assemble the differential case, using new thrust washers, and lubricate all parts before assembling.

NOTE—Before bolting the halves of the differential case together, be sure to align the marks which were made before the case was taken apart. After the case is fastened securely, run locking wire through the screw or bolt heads. (6)—Lubricate the differential bearings and place them in position on the hubs of the case. (7)—Assemble the drive pinion assembly in the carrier, replacing the original quantity of shims temporarily. (8)—Assemble the differential assembly in the carrier and install the bearing caps and adjusting nuts, drawing the nuts up until the marks which were made on the nuts and caps before disassembly are in the original position, then tighten the cap screws until the lock washers just flatten out. (9)—If new parts were installed or an adjustment was necessary, tighten the differential bearing adjusting nuts with sufficient force to seat the bearing cups solidly against the rollers. (10)—Back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cups. (11)—Loosen the right adjusting nut and tighten the

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

left nut—at the same time turning the ring gear—until all lash is removed, then back off the left nut one turn. (12)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. (13)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .005" to .010". (14)—If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If less than specified, loosen the left nut one notch and tighten the right nut one notch. (15)—When the correct lash is established, tighten the bearing cap lock screws securely and recheck the backlash. If correct, install the adjusting nut locks and lock the adjustment.

NOTE—The endwise adjustment of the drive pinion is controlled by the shims between the bearing cage flange and the housing. These shims are available in several thicknesses, and if adjustment is necessary, the bearing cage must be removed. In order not to disturb the ring gear adjustment, the differential assembly can be swung out to permit the pinion to be removed without disturbing the right adjusting nut, as already mentioned in the disassembly chapter. (16)—When the adjustments are completed, turn the thrust block adjusting screw all the way in to be sure the thrust block is seated on the end of the screw. (17)—Back off the screw and then tighten it again until the block contacts the ring gear. (18)—Finally, back off the screw from 1/6 to 1/4 turn and tighten the lock nut. (19)—Install the oil distributor collector in the carrier, being sure the short bevel is placed against the back of the ring gear in order to line up the locating screw with the hole in the collector. (20)—Assemble the spring and screw in the plug, or the plate and cap screws, whichever equipped. (21)—Assemble the carrier to the housing, using new gaskets under the inspection cover and carrier, and fasten the cap screws securely, using new lock washers under the cap screws.

NOTE—Be sure the breather on the inspection cover is not clogged. (22)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (23)—Adjust the bearings by tightening the bearing adjusting nuts until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (24)—Install the axle shafts, being sure that the tapered dowels are in place on all studs, then tighten the stud nuts securely.

NOTE—When the flange nuts are drawn up tight, there should always be a slight clearance between the lock washer and the flange. No clearance at this point indicates excessive wear on the studs, flange holes or tapered dowels. (25)—Complete the assembly by attaching the propeller shaft flange to the pinion shaft flange, lining up the marks which were made before disassembly.

GROUP No. 118

Figs. 157, 158

CHEVROLET 1940-42 1½ TON TRUCK HYPOID GEARS — HOTCHKISS DRIVE

DISASSEMBLE

(1)—To remove the axle shaft, bend the lugs of the lock plate away from the bolt heads with a cold chisel and hammer. (2)—Remove the cap screws and lock plate, after which the axle shaft and gasket can be removed.

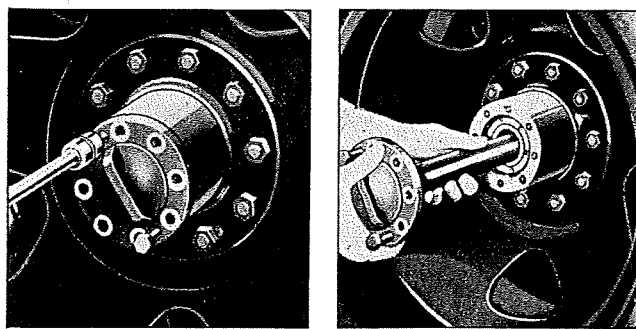


Fig. 157—Group No. 118 Rear Axle
Removing Axle Shaft of 1936-42 Chevrolet
1½ Ton Truck

(3)—To remove the wheel bearing, remove the wheel and raise the lip of the lock from the notch in the lock nut. (4)—Remove the lock nut and then remove the lock, inner adjusting nut and thrust washer. (5)—Remove the hub and drum assembly. (6)—Install clamp on brake wheel cylinder. (7)—Remove inner bearing and oil seal with a puller. (8)—To remove the outer bearing, tap the outer race to relieve the tension at the snap ring. (9)—Then remove the snap ring on the inside of the hub. (10)—Remove the bearing by driving on the outer race of the bearing with a long 1/8" punch through the cap screw holes in the end of the hub. This will also bring out the inner race and roller assembly. Use care to engage the edge of the race with the punch and not damage the bearing seat in the housing. Also make sure to drive the race out evenly.

The oil slinger is a drive fit in the housing and if it is removed it must be replaced with a new one.

(11)—To remove the differential carrier from the axle, drain the lubricant, remove the differential cover and the axle shafts. (12)—Split the rear universal

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

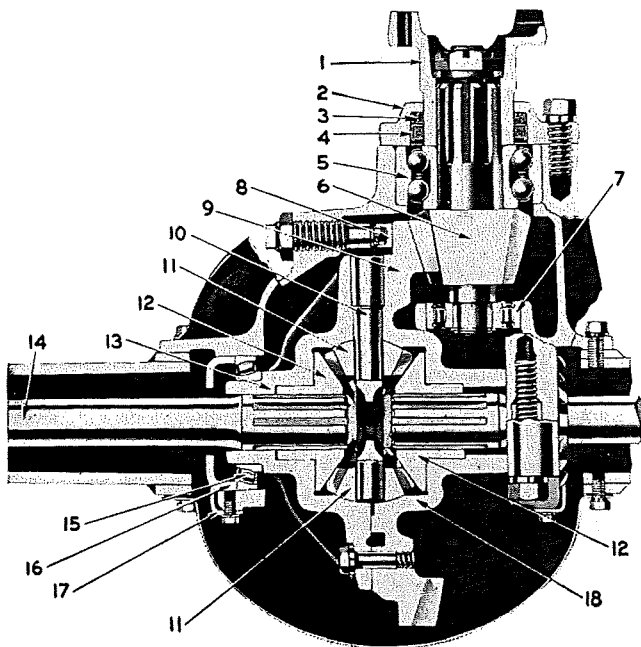


Fig. 158—Group No. 118 Rear Axle

- | | |
|------------------------|----------------------------------|
| 1—Universal joint yoke | 10—Differential spider |
| 2—Oil seal retainer | 11—Spider gear |
| 3—Oil seal packing | 12—Side gear |
| 4—Oil seal | 13—Differential case, left half |
| 5—Double row bearing | 14—Axle shaft |
| 6—Drive pinion | 15—Differential bearing |
| 7—Pilot bearing | 16—Differential adjusting nut |
| 8—Ring gear thrust pad | 17—Adjusting nut lock |
| 9—Ring gear | 18—Differential case, right half |

joint and drop the universal joint. (13)—Remove the bolts and lock washers which hold the differential carrier assembly to the axle housing and remove the differential carrier. (14)—Mount the assembly in a bench vise and remove the ring gear thrust pad from the side of the carrier. (15)—Remove the differential adjusting nut locks. (16)—Remove the bearing cap bolts and lockwashers. Remove the bearing caps. (17)—Then remove the differential case and ring gear assembly from the carrier. Remove the bolts from the pinion bearing retainer and oil seal and remove the pinion and shaft assembly from the carrier.

(18)—To disassemble the pinion, clamp the universal joint rear yoke in a vise and remove the cotter pin, nut and washer from the end of the pinion shaft. (19)—The universal joint flange, bearing retainer and oil seal may then be removed. (20)—To remove the rear pinion bearing, take off the lock ring and then press the pinion and shaft out of the bearing. Pressure must be exerted against the inner race, otherwise the bearing will be damaged. (21)—To remove the front bearing, install a bearing remover over the pinion teeth and against the inner race of the double row bearing. (22)—Then press the bearing off the pinion shaft.

(23)—Remove the differential bearings from the case with a bearing puller which pulls against the inner race of the bearings. (24)—To disassemble the differential make sure that the case halves are marked so that they can be assembled in their original position. (25)—Remove the bolts from the case. (26)—Lift off the case cover and remove the differential gears and pinions. (27)—The ring gear may be removed from the right side of the case by tapping it with a soft-faced hammer.

INSPECTION

(1)—Wash all parts in clean gasoline. (2)—Inspect the pinion for worn or chipped teeth. (3)—Inspect the splines on the pinion shaft for wear or scoring. (4)—Oil the bearings and turn them slowly by hand to check for roughness. (5)—The pinion bearings should be a close push fit in the carrier. (6)—Inspect the oil seal in the pinion bearing retainer and replace with a new one if necessary.

(7)—Check the differential gears for chipped, cracked or scored teeth. (8)—Inspect the differential side gear and pinion thrust surfaces in the housing halves for wear or score marks. (9)—Check the fit of the side gear hubs in the differential case halves. (10)—The fit of the pinions should be checked on the spider. (11)—The differential side bearings should be carefully inspected for worn, scored or broken rollers. (12)—They should then be oiled and rotated by hand to check for roughness. Any damaged or worn parts should be replaced.

ASSEMBLE

(1)—To assemble the pinion, press the front double row bearing onto the pinion shaft with the extended portion of the bearing inner race toward the back of the gear teeth. (2)—Press the rear bearing on the end of the shaft with the chamfered side of the inner race towards the pinion. (3)—Install the lock ring. (4)—Slide the pinion bearing retainer and oil seal over the universal joint yoke. (5)—If replacement of the oil seal is necessary, install the felt packing toward the bottom of the recess and then the oil seal with the open end of the leather toward the pinion bearing. The oil seal should be pressed down against the felt packing. Soak a new leather oil seal in light engine oil at least one hour before installing it. (6)—Install the pinion bearing retainer gasket and then slide the universal joint yoke over the splines of the pinion shaft until it contacts the inner race of the bearing. (7)—Place the flat washer on the end of the pinion shaft and tighten the nut to a torque load of 160 to 280 ft. lbs. (8)—Lock the nut with a cotter pin.

(9)—When assembling the differential, the flanges of the case, ring gear pilot and the back of the ring gear must be clean and free from burrs. (10)—When replacing the ring gear, use two guide pins made from the differential and ring gear screw. (11)—Their ends should be slightly tapered and screwdriver slots cut

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

in them so that they can be easily removed. (12)—Lubricate the differential side gears and pinions and install them in the left half of the differential case. (13)—Assemble the right side of the case to the left side, being sure to line up the marks on the case halves. (14)—Install the two guide pins. (15)—Slip the ring gear over the pilot diameter of the right half of the differential case. (16)—Install the differential to ring gear cap screws and lock washers, leaving the pilots in place and tighten the screws evenly one turn at a time until the ring gear face is flush with the case flange. (17)—Remove the guide pins and install the two remaining bolts and lockwashers. (18)—Then pull up all bolts tight. (19)—Assemble the differential bearings to the case with a suitable driver. The wide side of the inner race must be towards the case.

(20)—Place the differential carrier in a vise and install the bearing cap dowels in the carrier or in the bearing caps. (21)—Assemble the pinion assembly to the carrier using new gaskets and tighten the pinion bearing retainer bolts securely. (22)—Install the differential assembly in the carrier. (23)—Install the bearing caps, making sure the marks on the caps line up with the marks in the carrier. (24)—Install the cap screws and tighten them until the lock washers just flatten out. (25)—Screw the adjusting nuts into the carrier, making sure that they turn freely. (26)—Tighten them snugly to straighten the bearing outer races. (27)—Back off the right adjusting nut and tighten the left adjusting nut just to a point where all lash between the ring gear and the pinion is removed. (28)—Then back off the left nut approximately two notches and to a locking position. (29)—Tighten the right nut to a solid position. (30)—Back off the right nut free of the bearing, then tighten the nut until all play is removed from the bearing and then one or two notches more to a locking position.

(31)—Ring gear backlash should be from .005" to .008". If it is more than this, loosen the right adjusting nut one notch and tighten the left nut one notch. (32)—If less than this, loosen the left nut one notch and tighten the right nut one notch. (33)—Tighten the cap screws and recheck the ring gear and pinion backlash with a dial gauge. (34)—Assemble and tighten the adjusting nut locks. (35)—Examine the bronze tip of the ring gear thrust pad and if worn, install a new one. (36)—Install the thrust pad and tighten the screw until the bronze tip lightly engages the back of the ring gear while rotating the gear. (37)—Back off the screw 1/12 turn and then tighten the lock nut, making sure the screw does not turn during the locking process.

(38)—Install the differential carrier in the housing with a new gasket between the carrier and the housing. (39)—Install the cap screws and tighten them securely.

(40)—To replace the wheel bearings, place the inner race and roller assembly and the outer race in the wheel hub with the thin edge of the outer race downward.

(41)—With a suitable wheel bearing replacer, press the bearing in the hub. (42)—Press the race only far enough to install the snap ring in an arbor press. (43)—Install the snap ring in the groove on the inside of the hub. (44)—Use a driver through the cap screw holes in the end of the hub to force the outer race back in positive contact with the snap ring. (45)—To replace the inner bearing, place the outer race on the bearing in the wheel hub with the wide side of the face down. (46)—Use a driver to press the race against its seat. (47)—Install the inner race and roller assembly. (48)—Install the oil seal with a suitable tool and an arbor press. (49)—Lock the seal in place by prick punching at three equally spaced places. (50)—Install the wheel hub and drum assembly, turning the hub to properly line up the bearings. (51)—Install the thrust washer and adjusting nut.

(52)—To adjust the wheel bearings, tighten the adjusting nut and then back it off 45 degrees. (53)—Turn the wheel hub by hand to make sure the hub turns freely. (54)—Install the adjusting nut lock and check the alignment of the tangs with the slots in the nut. Rotate the hub by hand, grasping the hub at the wheel bolts, to see that the bearings are properly seated and that the hub turns freely. (55)—Bend the tang on the lock down into the notch of the adjusting nut. (56)—Install the outer lock nut and pull it up tight to prevent any loosening of the adjusting nut. (57)—Bend the tang of the lock into the notch of the lock nut.

(58)—Install a new axle shaft flange gasket on the axle shaft and push the shaft into the housing. (59)—Use a new lock plate at the axle shaft cap screws and insert the cap screws in the axle shaft flange, tightening them alternately and make sure that they are pulled tight. (60)—Then bend the tangs of the lock plate against the heads of the cap screws. (61)—Assemble the rear universal joint. (62)—Replace the axle housing cover and gasket. (63)—Refill the rear axle with the proper lubricant to the level of the filler plug.

GROUP No. 119

Figs. 159, 160

CHEVROLET 1936-39 1½ TON

Spiral Bevel Gears—Torque Tube Drive
Also 1940 1½ Ton Hypoid Gears Torque Tube Drive

DISASSEMBLE

(1)—To remove the axle shaft, bend the lugs of the lock plate away from the bolt heads with a cold chisel and hammer. (2)—Remove the cap screws and lock plate, after which the axle shaft and gasket can be removed. (3)—To remove the wheel bearing,

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

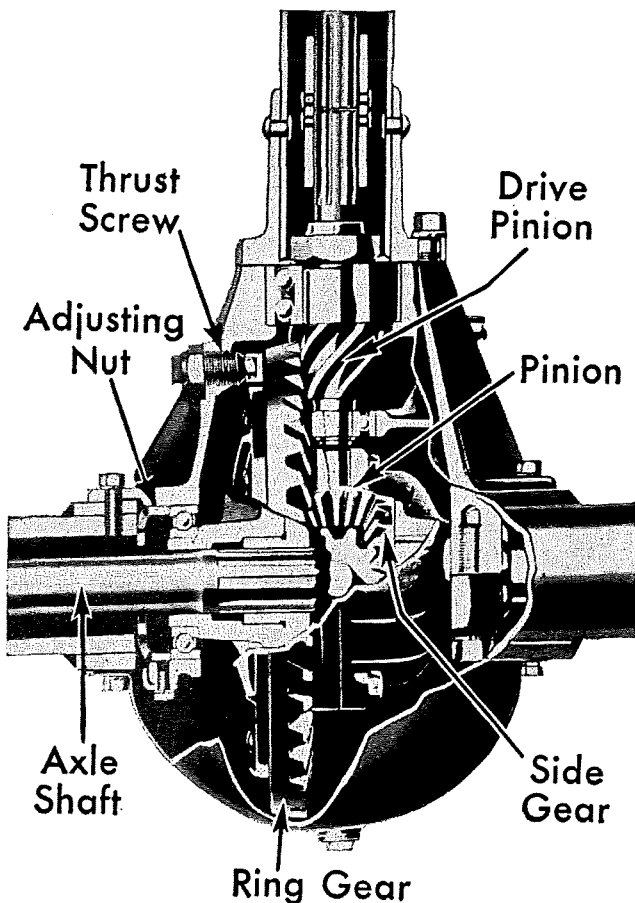


Fig. 159—Group No. 119 Rear Axle

remove the wheel and raise the lip of the lock from the notch in the lock nut. (4)—Remove the lock nut and then remove the lock, inner adjusting nut and thrust washer. (5)—Remove the hub and drum assembly. (6)—Install clamp on brake wheel cylinder. (7)—Remove inner bearing and oil seal with a puller. (8)—To remove the outer bearing, tap the outer race to relieve the tension at the snap ring. (9)—Then remove the snap ring on the inside of the hub. (10)—Remove the bearing by driving on the outer race of the bearing with a long $\frac{1}{8}$ " punch through the cap screw holes in the end of the hub. This will also bring out the inner race and roller assembly. Use care to engage the edge of the race with the punch and not damage the bearing seat in the housing. Also make sure to drive the race out evenly. The oil slinger is a drive fit in the housing and if it is removed it must be replaced with a new one. (11)—To remove the differential carrier, remove the bolts from the universal ball retainer back of the transmission and slide the retainer and ball back on the front propeller shaft housing. (12)—Remove the trunnion bearing lock rings and drive the trunnion bearings out of the rear

yoke of the universal joint and slide the yoke back on the shaft. (13)—Remove the two bolts which mount the front propeller shaft assembly to the frame cross member, then lower the assembly and pull it forward to remove it from the rear axle propeller shaft and torque tube. (14)—Remove the bolts and lock washers which retain the differential assembly to the housing and remove the differential carrier. (15)—Mount the assembly in a vise and remove the ring gear thrust pad. (16)—Remove the differential adjusting nut locks. (17)—Remove the bearing cap bolts and lock washers. (18)—The bearing caps may now be removed. (19)—Then remove the differential case and ring gear assembly from the carrier. (20)—Remove the torque tube to differential carrier bolts and remove the torque tube. (21)—Remove the propeller shaft assembly from the differential carrier. It may be necessary to use a soft drift and hammer to drive out the propeller shaft and pinion if the bearings are tight in the carrier. (22)—Clamp the propeller shaft assembly in a vise, cut off the rivet heads which hold the pinion shaft to the coupling and drive out the rivets. (23)—With a suitable tool, force the pinion with coupling assembled to it from the propeller shaft. (24)—Press the coupling from the pinion in an arbor press. (25)—Remove the lock ring from the front bearing and press the pinion and shaft out of the bearings. Pressure must be exerted against the inner race. (26)—Remove the pinion bearing retaining nut. (27)—Then press the double row ball bearing off the shaft. Remove the differential bearings from the case with a bearing puller which pulls against the inner race of the bearings. To disassemble the differential make sure that the case halves are marked so that they can be assembled in their original position. Remove the bolts from the case. Lift off the case cover and remove the differential gears and pinions. The ring gear may be removed from the right side of the case by tapping it with a soft-faced hammer.

INSPECTION

(1)—Wash all parts in clean gasoline. (2)—Inspect the pinion for worn or chipped teeth. (3)—Inspect the splines on the pinion shaft for wear or scoring. (4)—Oil the bearings and turn them slowly by hand to check for roughness. (5)—The pinion bearings should be a close push fit in the carrier. (6)—Inspect the oil seal in the pinion bearing retainer and replace with a new one if necessary. (7)—Check the differential gears for chipped, cracked or scored teeth. (8)—Inspect the differential side gear and pinion thrust surfaces in the housing halves for wear or score marks. (9)—Check the fit of the side gear hubs in the differential case halves. (10)—The fit of the pinions should be checked on the spider. (11)—The differential side bearings should be carefully inspected for worn, checked, scored or broken rollers. (12)—They should then be oiled and rotated by hand to check for roughness. Any damaged or worn parts should be replaced.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

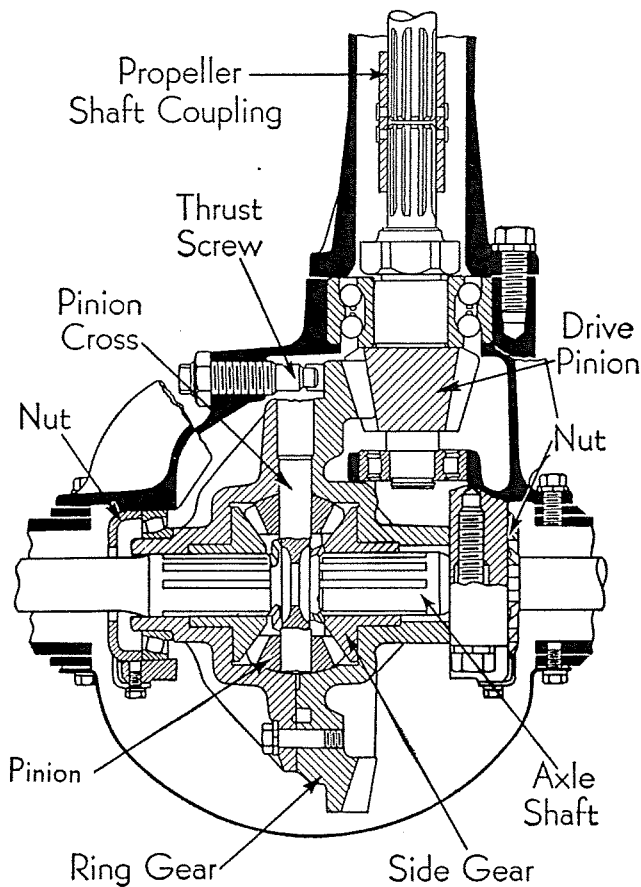


Fig. 160—Group No. 119

1940 1½ Ton Chevrolet Truck with Hypoid Axle

ASSEMBLE

(1)—To assemble the pinion, press the double row ball bearing on the pinion shaft and install a new retaining nut and pull it down tight. (2)—Then using a cold chisel, cut through the sleeve on the nut in line with the edge of the keyway in the pinion shaft. (3)—Lock the nut by driving the edge of the nut sleeve into the keyway with a punch. (4)—Press the roller bearing on the pinion shaft with the chamfered side of the inner race toward the pinion. (5)—Install the lock ring. (6)—Press the coupling on the pinion shaft so that the hole in the pinion shaft and the hole in the coupling line up. (7)—Press the pinion and coupling on the propeller shaft, making sure that the rivet hole in the coupling lines up with the rivet hole in the propeller shaft. (8)—Insert the flat head rivets and rivet over the ends. (9)—Mount the assembly in V-blocks, with one V-block at the double row bearing and the other in the ground diameter which is back of the spline at the front end of the propeller shaft.

The maximum indicator runout to which this assembly should be straightened is .003" at the roller bearing, .010" at the finished part of the propeller shaft just ahead of the coupling, .015" in the rough section at the middle of the propeller shaft and .005" at the extreme front end of the propeller shaft. (10)—When assembling the differential, the flanges of the case, ring gear pilot and the back of the ring gear must be clean and free from burrs. (11)—When replacing the ring gear, use two guide pins made from the differential and ring gear screw. Their ends should be slightly tapered and screwdriver slots cut in them so that they can be easily removed. (12)—Lubricate the differential side gears and pinions and install them in the left half of the differential case. (13)—Assemble the right side of the case to the left side, being sure to line up the marks on the case halves. (14)—Install the two guide pins. (15)—Slip the ring gear over the pilot diameter of the right half of the differential case. (16)—Install the differential to ring gear cap screws and lock washers, leaving the pilots in place and tighten the screws evenly one turn at a time until the ring gear face is flush with the case flange. (17)—Remove the guide pins and install the two remaining bolts and lock washers. (18)—Then pull all bolts up tight. (19)—Assemble the differential bearings to the case with a suitable driver. The wide side of the inner race must be towards the case. (20)—Place the differential carrier in a vise and install the bearing cap dowels in the carrier or in the bearing caps. (21)—Assemble the pinion assembly to the carrier using new gaskets and tighten the pinion bearing retainer bolts securely. (22)—Install the differential assembly in the carrier. (23)—Install the bearing caps, making sure the marks on the caps line up with the marks in the carrier. (24)—Install the cap screws and tighten them until the lock washers just flatten out. (25)—Screw the adjusting nuts into the carrier, making sure that they turn freely. (26)—Tighten them snugly to straighten the bearing outer races. (27)—Back off the right adjusting nut and tighten the left adjusting nut just to a point where all lash between the ring gear and the pinion is removed. (28)—Then back off the left nut approximately two notches and to a locking position. (29)—Tighten the right nut to a solid position. (30)—Back off the right nut free of the bearing, then tighten the nut until all play is removed from the bearing and then one or two notches more to a locking position. (31)—Ring gear backlash should be from .005" to .008". If it is more than this, loosen the right adjusting nut one notch and tighten the left nut one notch. (32)—If less than this, loosen the left nut one notch and tighten the right nut one notch. (33)—Tighten the cap screws and recheck the ring gear and pinion backlash with a dial gauge. (34)—Assemble and tighten the adjusting nut locks. (35)—Examine the bronze tip of the ring gear thrust pad and if worn, install a new one. (36)—Install the thrust pad and tighten the screw until the bronze tip lightly engages the back of the ring gear while rotating

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

the gear. (37)—Back off the screw 1/12 turn and then tighten the lock nut, making sure the screw does not turn during the locking process. (38)—Install the differential carrier in the housing with a new gasket between the carrier and the housing. (39)—Install the cap screws and tighten them securely. (40)—To replace the wheel bearings, place the inner race and roller assembly and the outer race in the wheel hub with the thin edge of the outer race downward. (41)—With a suitable wheel bearing replacer, press the bearing in the hub. (42)—Press the race only far enough to install the snap ring in an arbor press. (43)—Install the snap ring in the groove on the inside of the hub. (44)—Use a driver through the cap screw holes in the end of the hub to force the outer race back in positive contact with the snap ring. (45)—To replace the inner bearing, place the outer race on the bearing in the wheel hub with the wide side of the face down. (46)—Use a driver to press the race against its seat. (47)—Install the inner race and roller assembly. (48)—Install the oil seal with a suitable tool and an arbor press. (49)—Lock the seal in place by prick punching at three equally spaced places. (50)—Install the wheel hub and drum assembly, turning the hub to properly line up the bearings. (51)—Install the thrust washer and adjusting nut. (52)—To adjust the wheel bearings, tighten the adjusting nut and then back it off 45 degrees. (53)—Turn the wheel hub by hand to make sure the hub turns freely. (54)—Install the adjusting nut lock and check the alignment of the tangs with the slots in the nut. Rotate the hub by hand, grasping the hub at the wheel bolts, to see that the bearings are properly seated and that the hub turns freely. (55)—Bend the tang on the lock down into the notch of the adjusting nut. (56)—Install the outer lock nut and pull it up tight to prevent any loosening of the adjusting nut. (57)—Bend the tang of the lock into the notch of the lock nut. (58)—Install a new axle shaft flange gasket on the axle shaft and push the shaft into the housing. (59)—Use a new lock plate at the axle shaft cap screws and insert the cap screws in the axle shaft flange, tightening them alternately and make sure that they are pulled tight. (60)—Then bend the tangs of the lock plate against the heads of the cap screws. (61)—Assemble the rear universal joint on the front propeller shaft assembly to the propeller shaft and torque tube. (62)—Bolt the front propeller shaft assembly to the frame crossmember. (63)—Assemble the front universal joint by installing the chamfered side, which is on the inside diameter, of the trunnion bearing toward the inside of the yoke. (64)—Drive the trunnions into place until the grooves line up with the slots in the yoke. (65)—Drive the lock ring into place, using new lock rings. (66)—Slide the retainer and universal ball over the front propeller shaft housing. (67)—Bolt the retainer to the back of the transmission case.

GROUP No. 120

Fig. 161

Clark Model R-1300

DISASSEMBLE

(1)—Disconnect the propeller shaft flange from the pinion shaft flange. NOTE—Mark the flanges so they may be assembled in the original position. (2)—Unscrew the axle shaft flange nuts and pull out the shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which, the hubs may be removed. (4)—Take off the differential inspection cover. (5)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly. (6)—Back out the thrust block adjusting screw to allow the ring gear to clear the thrust block when removing the differential assembly. (7)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembling, the approximate adjustment will be readily obtained, then remove the bearing caps and lift out the differential assembly. (8)—Mark both halves of the differential case so that when assembled, the original position is maintained, then unfasten the both halves of the case, after which, the case may be separated and all the differential parts removed. (9)—If the ring gear is to be replaced, use a drill which is smaller than the diameter of the rivet head and drill the rivet from the differential case side, after which, punch out the rivets. (10)—Pull the drive pinion and bearing cage assembly out of the carrier. (11)—Clamp the pinion or universal flange in a vise and remove the flange retaining nut, then the flange, oil seal cover, adjusting nuts, front roller bearing, spacer and bearing cage may be removed.

NOTE—Collect the shims under the bearing cage, noting the quantity and thickness in order to facilitate adjustment when assembling. (12)—The rear bearing roller may now be removed from the pinion shaft.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced. (3)—The bronze thrust block is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain approximately .015" clearance. (4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or run-out

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts. (6)—Check the differential case flange for runout by bolting the two halves of the case together and mount the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced. (7)—After the ring gear is attached to the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Assemble the rear tapered bearing on the pinion shaft and install the bearing spacer. (2)—Place the bearing cage in position and assemble the front tapered bearing. (3)—Screw the bearing adjusting nut all the way up to be sure the bearings are seated, then back off the nut just enough to permit the cage to turn, yet not enough to allow it to spin. (4)—Install a new lock washer on the shaft and run the lock nut up tight, being careful not to change the adjustment. If necessary, back off the adjusting nut slightly. (5)—After the bearings are satisfactorily adjusted, bend one of the tabs of the lock washer over the adjusting nut and another over the lock nut to hold them securely in place. (6)—Install the drive pinion assembly in the carrier, replacing the original quantity of shims under the bearing cage. (7)—Install a new oil seal in the cover and replace the bolts which fasten the pinion cage assembly to the carrier. (8)—Lubricate the differential spider, pinions, side gears and thrust washers and assemble them in the differential case, lining up the marks on both halves of the case before installing the cap screws; after tightening the cap screws securely, thread locking wire through all the screw heads. (9)—Locate the differential case in the carrier and install the bearing caps and adjusting nuts, tightening the cap screws until the lock washers just flatten out.

NOTE—If new parts were installed or an adjustment is necessary, the adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. Then back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cup. (10)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (11)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. (12)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .007" to .010". If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. Now tighten the bearing cap lock screws securely and re-check the lash. When correct, install the adjusting nut locks and lock the adjustment. (13)—Screw the thrust block adjusting screw partly into the carrier. (14)—Lubricate the thrust block and hold it in place on the ring gear. (15)—Turn the adjusting screw up tight to permit the block to seat on the end of the screw. (16)—Continue turning the screw until the block contacts the ring gear, then back off the screw from $\frac{1}{6}$ to $\frac{1}{4}$ turn and tighten the lock nut. (17)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (18)—Lubricate the

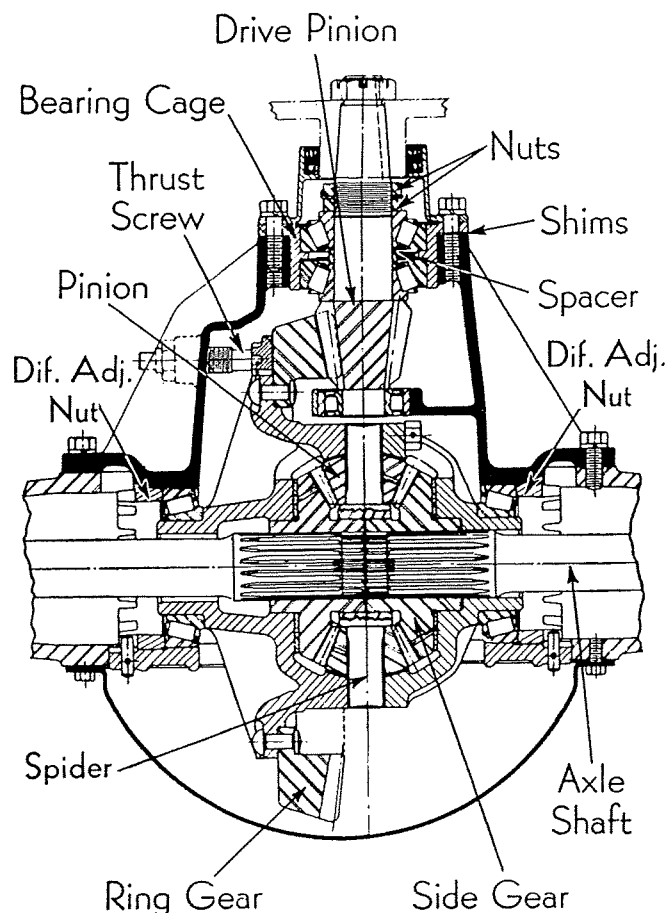


Fig. 161—Group No. 120 Clark R-1300

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (19)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (20)—Install the axle shafts, then tighten the nuts securely. (21)—Complete the assembly by installing the universal flange and propeller shaft.

GROUP No. 121

Fig. 162

Clark Models R-950, R-1100

DISASSEMBLE

(1)—Disconnect the propeller shaft from the pinion shaft flange. NOTE—Mark the flanges so they may be assembled in the original position. (2)—Unscrew the axle shaft flange bolts and pull out the shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the nuts and washers, after which, the hubs may be removed. (4)—Take off the differential inspection cover. (5)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly. (6)—Back out the thrust screw to allow the ring gear to clear when removing the differential assembly. (7)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembling, the approximate adjustment will be readily obtained, then remove the bearing caps. (8)—Mark both halves of the differential case so that when assembled, the original position is maintained, then remove the cap screws or bolts which attach both halves of the case, after which, the case may be separated and all the differential parts removed. (9)—Remove the cap screws which fasten the drive pinion bearing retainer to the carrier housing and pull out the drive pinion assembly. (10)—Clamp the universal flange in a vise and remove the flange retaining nut, after which, the flange, retainer and bearings may be removed from the pinion shaft.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks.

(2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced.

(3)—The thrust screw is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the screw should be turned in or out as required to obtain approximately .015" clearance.

(4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of

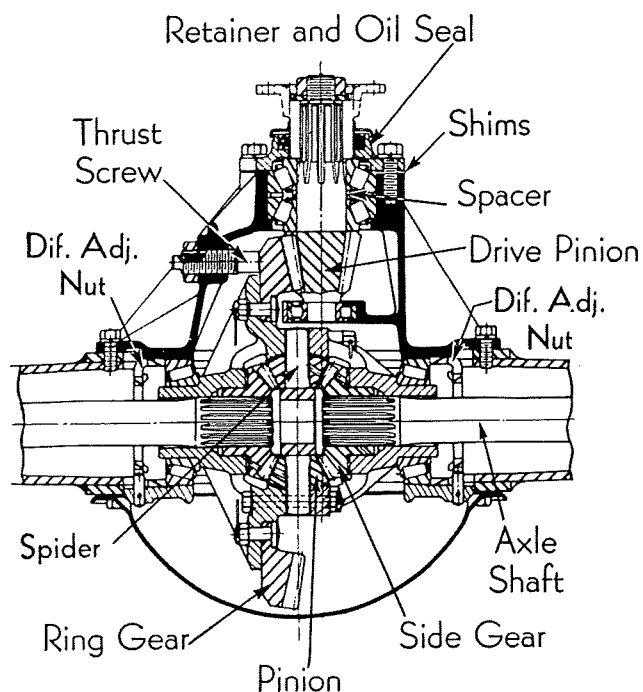


Fig. 162—Group No. 121 Clark R-950

the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced.

(5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts.

(6)—Check the differential case flange for runout by bolting the two halves of the case together and mount the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced.

(7)—After the ring gear is attached to the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Press the rear tapered bearing on the pinion shaft and install the bearing spacer. (2)—Install the forward tapered bearing in place. (3)—Use a new oil

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

seal in the bearing retainer and place the retainer over the universal flange hub, after which, install the flange on the pinion shaft, fastening the retaining nut securely. (4)—When the pinion bearings are properly adjusted, a slight drag should be felt when turning the pinion by hand. NOTE—If the bearings are too loose, or if end play is evident, a thinner spacer should be installed between the bearings, or, if too tight, use a thicker spacer. These spacers are available in several thicknesses. (5)—Lubricate the differential spider, pinions, side gears and thrust washers and assemble them in the differential case, lining up the marks on both halves of the case before installing the cap screws; after tightening the cap screws securely, thread locking wire through all the screw heads. (6)—Locate the differential case in the carrier and install the bearing caps and adjusting nuts, tightening the cap screws until the lock washers just flatten out. NOTE—If new parts were installed or an adjustment is necessary, the adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. Then back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cup. (7)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (8)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. (9)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .007" to .010". If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. Now tighten the bearing cap lock screws securely and recheck the lash. When correct, install the adjusting nut locks and lock the adjustment. (10)—Screw the thrust screw into the carrier and turn it in until it contacts the ring gear, then back it off from 1/6 to 1/4 turn and tighten the lock nut. (11)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (12)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (13)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (14)—Install the axle shafts and tighten the stud nuts securely. (15)—Complete the assembly by installing the propeller shaft.

GROUP No. 122

Fig. 163

Clark Models R-650, R-750

DISASSEMBLE

(1)—Disconnect the propeller shaft from the pinion shaft flange.

NOTE—Mark the flanges so they may be assembled in the original position. (2)—Unscrew the axle shaft bolts and pull out the shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the nuts and washers, after which, the hubs may be removed. (4)—Take off the differential inspection cover. (5)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly.

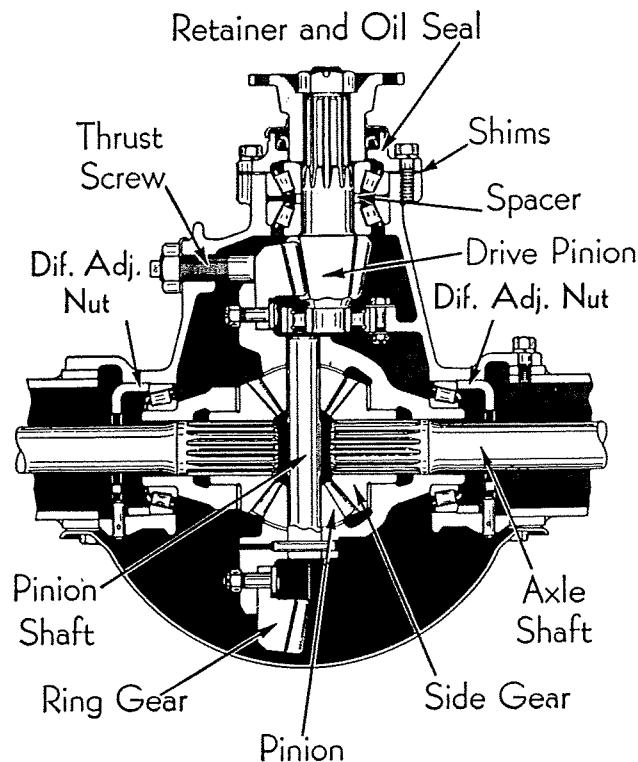


Fig. 163—Group No. 122 Clark R-650

NOTE—For axles equipped with a thrust screw, back out the screw to allow the ring gear to clear when removing the differential assembly. (6)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembling, the approximate adjustment will be readily obtained, then remove the bearing caps. (7)—Remove the differential lock pin and pull out the shaft; the differential parts are now loose and can be removed by hand. (8)—If the ring gear is riveted to the flange, use a drill which is smaller than the diameter of the rivet head and drill the rivets from

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

the differential case side, after which, punch out the rivets. (9)—Remove the cap screws which fasten the drive pinion bearing retainer to the carrier housing and pull out the drive pinion assembly. (10)—Clamp the universal flange in a vise and remove the flange retaining nut, then the flange, retainer and bearings may be removed from the pinion shaft.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced. (3)—The thrust screw is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the screw should be turned in or out as required to obtain approximately .015" clearance. (4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts. (6)—Check the differential case flange for runout by mounting the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced. (7)—After the ring gear is attached to the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Press the rear tapered bearing on the pinion shaft and install the bearing spacer. (2)—Install the forward tapered bearing in place. (3)—Use a new oil seal in the bearing retainer and place the retainer over the universal flange hub, after which, install the flange on the pinion shaft, fastening the retaining nut securely. (4)—When the pinion bearings are properly adjusted, a slight drag should be felt when turning the pinion by hand.

NOTE—If the bearings are too loose, or if end play is evident, a thinner spacer should be installed between the bearings. If the adjustment is too tight, use a

thicker spacer. These spacers are available in several thicknesses. (5)—Lubricate the differential pinions, side gears and thrust washers and install them into the differential case, then push in the pinion shaft, lining up the hole in the shaft with the hole in the case, after which, install the lock pin. (6)—Locate the differential case in the carrier and install the bearing caps and adjusting nuts, tightening the cap screws until the lock washers just flatten out.

NOTE—If new parts were installed or an adjustment is necessary, the adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. Then back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cup. (7)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (8)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. (9)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .007" to .010". If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. Now tighten the bearing cap lock screws securely and recheck the lash. When correct, install the adjusting nut locks and lock the adjustment. (10)—On axles equipped with a thrust screw, install the screw into the carrier and turn it in until it contacts the ring gear, then back off about $\frac{1}{4}$ turn. (11)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (12)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (13)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (14)—Install the axle shafts and tighten the stud nuts securely. (15)—Complete the assembly by connecting propeller shaft.

GROUP No. 123

Fig. 164

Clark Model B-373

DISASSEMBLE

(1)—Disconnect the propeller shaft from the pinion shaft flange, marking the flanges so that they may be assembled in their original position. (2)—Remove the axle shaft flange nuts and pull out the axle shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which the hubs may be removed. (4)—Remove the cap screws which fasten the differential

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

carrier to the axle housing and remove the carrier assembly. (5)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be disassembled with approximately the same drive gear adjustment. (6)—Remove the differential bearing cap screws and lift off the caps. (7)—Loosen the thrust block lock screw on the side of the differential carrier. Lift out the differential and ring gear. (8)—If it is necessary to remove the ring gear, remove the rivets which hold the ring gear to the differential case. (9)—Press the ring gear off the differential case. (10)—If the differential bearings are to be replaced, they can be removed from the differential case with a suitable bearing puller. (11)—

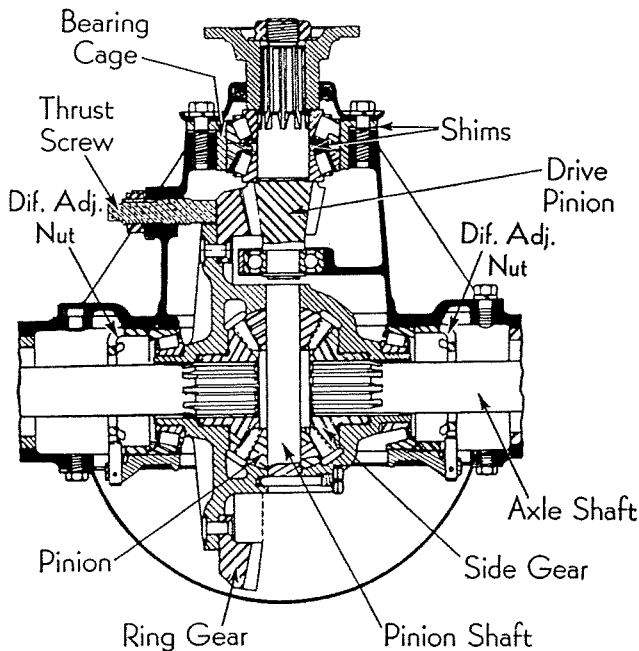


Fig. 164—Group No. 123 Clark B-373

Remove the differential pinion shaft lock screw and push out the differential pinion shaft. (12)—All the differential parts can then be removed by hand. (13)—Remove the cotter pin, nut and lock washer from the front of the pinion shaft and with a puller remove the universal joint flange. (14)—Remove the pinion bearing cap screws and remove the cap and oil seal. (15)—The drive pinion and bearings can now be removed from the carrier. (16)—If the pinion or bearings are to be replaced, the pinion can be pressed out of the bearings. (17)—Collect the shims between the bearing sleeve flange and the end of the carrier and note the thickness so that the original thickness of shims will be used when the parts are reassembled. (18)—The rear ball bearing may now be removed from the pinion shaft.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks.

(2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced.

(3)—The bronze thrust block is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain from .010" to .012" clearance under no load.

(4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts, being sure to assemble the tapered dowels in the stud ends, and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced.

(5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts.

(6)—Check the differential case flange for runout by mounting the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced.

(7)—Rivet the ring gear to the differential case flange and take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Press the rear bearing cone on the pinion shaft. (2)—If the bearing cups were removed from the bearing sleeve press them into their seats. (3)—Assemble the pinion and the rear bearing cone to the sleeve and then install the spacer and rear bearing cone on the pinion shaft. No end play should be allowed at these bearings. (4)—Play can be adjusted by shims between the bearing cones. (5)—Reducing the thickness of the shims reduces the end play.

(6)—The differential can be assembled in the reverse order from which it was disassembled. (7)—Push the differential pinion shaft into the case, making sure

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

that the hole for the lock screw lines up with the hole in the case. (8)—Tighten the lock screw in place. (9)—Lubricate the differential bearings and press them on the differential case.

(10)—Assemble the drive pinion and bearings to the carrier housing, using the original shims between the bed of the carrier and the bearing sleeve flange. (11)—Replace the bearing cap and oil seal and tighten the companion flange in place, using a cotter pin in the nut to hold it in position. (12)—Assemble the differential assembly and bearings in the carrier in the housing. (13)—Replace the bearing adjusting nuts and the bearing caps, and tighten the caps in position. (14)—Turn the adjusting nuts until the marks on them indicate that they are in their original position. (15)—Then tighten the bearing cap screws and adjusting screw locks.

There should be no play in the differential bearings. (16)—If an adjustment is necessary, tighten the bearing adjusting nuts with sufficient force to seat the bearing cups solidly against the rollers. (17)—Back off the adjusting nuts to relieve strain and tighten them again slightly, against the bearing cups. (18)—Loosen the right adjusting nut and tighten the left nut, at the same time turning the ring gear, until all lash is removed. (19)—Then back off the left nut one turn. (20)—Tighten the right nut until it is snug and continue for one or two more notches, until a locking position is reached.

(21)—Check the tooth contact and if it is necessary to move the ring gear away from the pinion tighten the right nut and loosen the left nut an equal number of notches until the contact is correct. (22)—If the ring gear must be moved toward the pinion, tighten the left nut and loosen the right nut an equal number of notches. By turning both nuts the same amount, the bearing play will not be changed. (23)—The pinion can be moved toward or away from the ring gear by changing the thickness of the shims between the pinion bearing sleeve flange and the end of the carrier. (24)—Adding shims moves the pinion away from the ring gear and reducing the thickness of the shims moves the pinion toward the ring gear.

(25)—When this adjustment is completed, turn the thrust block screw in until it contacts the ring gear and then back it off just slightly. The clearance between the ring gear and the thrust block should be .010" to .012".

(26)—Assemble the carrier to the housing, using a new gasket and tighten the cap screws securely, using new lock washers under the screws. (27)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (28)—Adjust the bearings by tightening the bearing adjusting nuts until the wheel binds and then back them off just enough to permit the wheel to turn freely without end play. (29)—Install the axle shafts and tighten the flange nuts securely. (30)—Complete the assembly by attaching the universal joint flanges.

GROUP No. 124

Figs. 165, 166

DODGE 1936-LE, LF, LG, LH; 1937-ME, MF, MG, MH; 1938-RE, RF, RG, RH; 1939-TE, TF, TH

DISASSEMBLE

(1)—To remove the axle shaft, remove the axle drive shaft flange screws. (2)—Pull out the shaft. (3)—Straighten the tabs on the wheel bearing lock washers

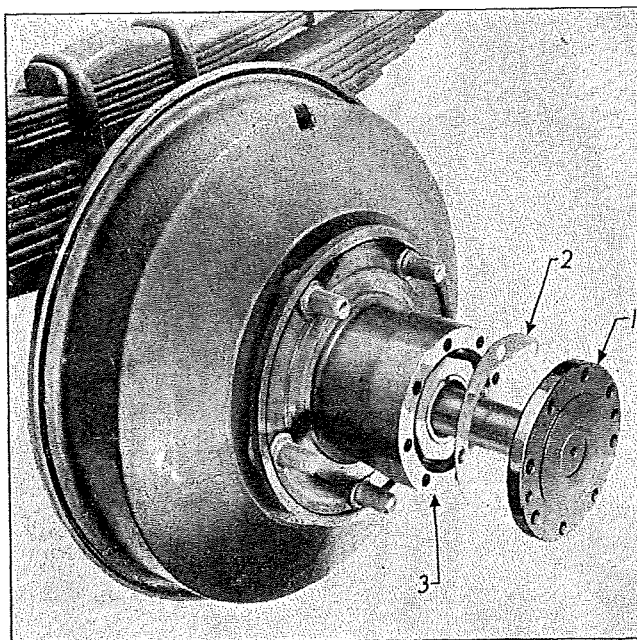


Fig. 165—Group 124 Removing Axle Shaft from Dodge Truck

1—Axle Shaft 2—Axle Shaft Gasket 3—Wheel Hub

and remove the lock nuts, washers and adjusting nuts, after which the hub may be removed. (4)—Remove the cap screws which hold the differential carrier assembly to the axle housing. (5)—Lift out the differential carrier. (6)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (7)—Remove the differential bearing cap screws and lift out the caps. (8)—Lift out the differential and ring gear assembly. (9)—With a puller remove the differential bearings.

(10)—To disassemble the ring gear from the case, remove the screws which hold the ring gear to the differential case. (11)—Push the ring gear off the differential case. (12)—Remove the differential pinion shaft.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

(13)—All differential parts will then be loose and can be lifted out of the case.

NOTE—The differential assembly must be removed before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

(14)—To remove the drive pinion, remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (15)—With a suitable tool, pull off the universal joint drive flange. (16)—Pull or drive the drive pinion back through the carrier case. (17)—The bearing spacer, front bearing and shims can then be removed from the front of the housing. (18)—The rear bearing cup can be removed from the rear of the housing with a puller. (19)—With a bearing puller, remove the rear bearing cone from the pinion shaft. (20)—The thrust screw can be removed from the side of the carrier housing.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced. (3)—The bronze thrust block is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain from .020" to .030" clearance under no load.

(4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts.

(6)—Check the differential case flange for runout by mounting the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced.

(7)—Bolt the ring gear to the differential case flange and take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

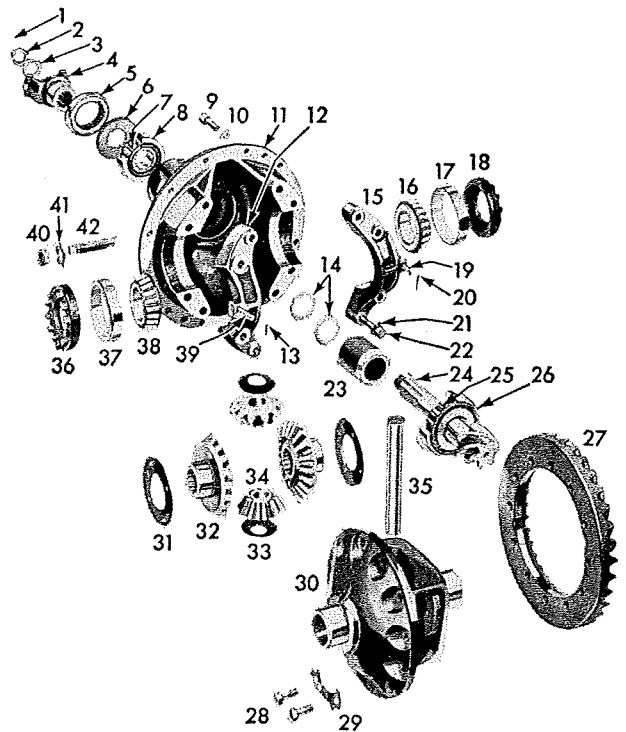


Fig. 166—Group No. 124 Rear Axle

- | | |
|--|---|
| 1—Cotter pin | 20—Cotter pin |
| 2—Rear axle drive pinion companion yoke nut | 21—Lock washer |
| 3—Rear axle drive pinion companion yoke washer | 22—Differential bearing cap screw |
| 4—Rear axle drive pinion companion yoke | 23—Rear axle drive pinion bearing spacer |
| 5—Rear axle drive pinion bearing oil seal | 24—Rear axle drive pinion |
| 6—Rear axle drive pinion front bearing washer | 25—Rear axle drive pinion bearing cone—rear |
| 7—Rear axle drive pinion bearing cone—front | 26—Rear axle drive pinion bearing cup—rear |
| 8—Rear axle drive pinion bearing cup—front | 27—Rear axle drive gear |
| 9—Differential carrier screw | 28—Rear axle drive gear screw |
| 10—Lock washer | 29—Rear axle drive gear screw lock |
| 11—Differential carrier and cap assembly | 30—Differential case |
| 12—Differential carrier bearing cap | 31—Differential side gear thrust washer |
| 13—Cotter pin | 32—Differential side gear |
| 14—Rear axle drive pinion bearing shims | 33—Differential pinion gear thrust washer |
| 15—Differential carrier bearing cap | 34—Differential pinion gear |
| 16—Differential bearing cone | 35—Differential pinion gear shaft |
| 17—Differential bearing cup | 36—Differential bearing adjuster |
| 18—Differential bearing adjuster lock | 37—Differential bearing cup |
| 19—Differential bearing adjuster lock | 38—Differential bearing cone |
| | 39—Differential bearing adjuster lock |
| | 40—Rear axle drive gear thrust screw lock nut |
| | 41—Rear axle drive gear thrust screw lock |
| | 42—Rear axle drive gear thrust screw |

ASSEMBLE

(1)—If the rear bearing cone was removed or a new drive pinion is to be installed, press the rear bearing cone on the drive pinion. (2)—If the front or rear bearing cups were removed from the carrier housing, press them in place. (3)—Then replace drive pinion in the housing. (4)—Then slide the bearing spacer, original thickness of shims and the front bearing cone on the pinion shaft. (5)—Assemble the universal joint flange on the shaft and tighten it in place. (6)—Check the end play of the pinion shaft. It should be .0015" to .0025" tight. (7)—If the play is too great, remove the flange and front bearing cone and remove the necessary shims. If it is too tight, the necessary

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

thickness of shims should be added. (8)—Press the front bearing cone in place when the play is correct. (9)—Then install the oil seal with a suitable tool and tighten the universal joint flange in place. (10)—Insert a cotter pin in the shaft to hold the nut in position.

(11)—To assemble the differential, press the differential bearing in place. (12)—Install the side gear thrust washer and side gears in the case. (13)—Mesh the differential pinions with the side gears, holding the thrust washers on the back of the gears. (14)—Rotate the side gears until the holes through the center of the pinions are in line with the hole for the pinion shaft in the case. (15)—Press the pinion shaft in place. (16)—Locate the differential case in the carrier. (17)—Install the differential bearing caps and adjusting nuts. (18)—Draw up on the adjusting nuts until the marks show that the bearings are in their original position. (19)—Then tighten the screws in the bearing caps. The backlash should be .006" to .010". (20)—If an adjustment is necessary, tighten the differential adjusting nuts with sufficient force to drive the bearing cups against the shoulders on the differential case. (21)—Back off the adjusting nuts to relieve strain and then tighten them again slightly against the bearing cup. The assembly should rotate with a slight drag when turning the ring gear by hand. The assembly must not spin. (22)—Insert the thrust screw in the side of the carrier housing and turn it in until it strikes the ring gear. (23)—Back it off $\frac{1}{3}$ turn and lock it in position with the lock nut. This gives about .030" clearance.

(24)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (25)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (26)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (27)—Install the axle shafts, being sure that the tapered dowels are in place on all studs, then tighten the stud nuts securely. NOTE—When the flange nuts are drawn up tight, there should always be a slight clearance between the lock washer and the flange. No clearance at this point indicates excessive wear on the studs, flange holes or tapered dowels. (28)—Complete the assembly by installing the universal flange and propeller shaft.

GROUP No. 125

Fig. 167

DODGE 1940 — VF, VM, VG, VH;
1941-1942 — WF, WFM, WH, WHM

DISASSEMBLE

(1)—To remove the axle shaft, remove the axle drive shaft flange screws. (2)—Pull out the shaft. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nut, washer and adjusting nut, after which the hub may be removed. (4)—Remove the

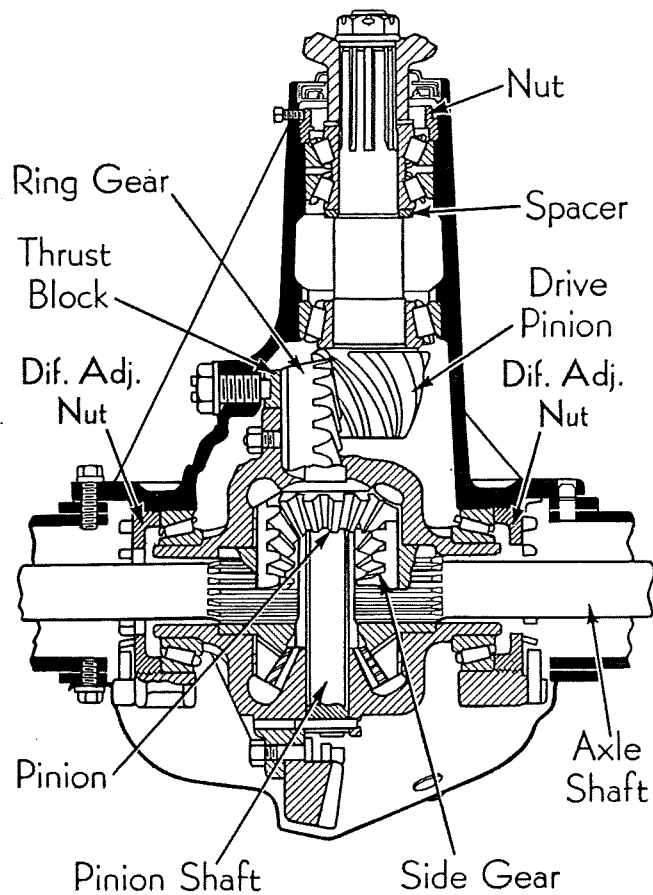


Fig. 167—Group No. 125 Rear Axle

cap screws which hold the differential carrier assembly to the axle housing. (5)—Lift out the differential carrier. (6)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (7)—Remove the differential bearing cap screws and lift out the caps. (8)—Lift out the differential and ring gear assembly. (9)—With a puller remove the differential bearings.

(10)—To disassemble the ring gear from the case, remove the screws which hold the ring gear to the differential case. (11)—Push the ring gear off the differential case. (12)—Remove the differential pinion shaft. (13)—All differential parts will then be loose and can be lifted out of the case.

NOTE—The differential assembly must be removed before removing the drive pinion, but it is not necessary to remove the drive pinion or the differential assembly for removal of the drive pinion bearing oil seal.

(14)—To remove the drive pinion, remove the cotter pin, drive pinion flange nut and washer from the front end of the pinion shaft. (15)—With a suitable tool, pull off the universal joint drive flange.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

(16)—With a puller, remove the oil seal from the front of the housing. (17)—Lift out the front bearing washer. (18)—Unscrew and remove the front bearing retainer lock screw and the bearing retainer nut. (19)—Pull the drive pinion out through the rear of the differential carrier. (20)—The washer just ahead of the front bearing does not fit the pinion shaft tightly and will drop into the carrier. (21)—Tap the center and front bearing cones from the pinion shaft with a drift and hammer. (22)—With a puller, remove the rear bearing cone from the pinion shaft. (23)—Drive the bearing cup for the front and center bearings out of the housing with a drift and hammer. (24)—The rear bearing cup can be removed from the housing with a puller. (25)—Remove the ring gear thrust screw from the side of the carrier.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced. (3)—The bronze thrust block is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain from .010" to .030" clearance under no load.

(4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced.

(5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts.

(6)—Check the differential case flange for runout by mounting the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced.

(7)—Bolt the ring gear to the differential case flange and take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—If the rear bearing cone was removed or a new drive pinion is being installed, press the rear bearing cone on the drive pinion. (2)—If the rear bearing cup was removed from the carrier, press it into its seat. (3)—The front bearing cup is marked with a letter Y and the marked end must always be assembled toward the front of the shaft. (4)—The cone marked Y should be mounted on the shaft so that it will be matched with the marked cup. (5)—Slip the drive pinion spacer on the pinion shaft against the shoulder of the shaft and press the rear center bearing cone in place against it. (6)—Then replace the pinion in the housing. (7)—Press the front bearing cone on the shaft. (8)—Place the washer on the shaft at the front of the bearing and tighten the companion flange on the end of the shaft. (9)—Then tighten the front bearing retainer nut against the front bearing cup. (10)—With both the nut and the flange tight, test each roller of the front bearing by pushing on the roller ends with the end of a file or an awl to determine if any of them are loose. (11)—If any looseness exists, use a thinner spacer at the rear of the center bearing cone. There should be no end play in the pinion shaft. The pinion bearings cannot be used to adjust the pinion gear. Tooth contact can only be adjusted at the differential bearings. (12)—When this is correct, remove the universal joint flange and replace the oil seal with a suitable tool. (13)—Then tighten the flange in place and insert a cotter pin in the nut to hold the nut in adjustment. (14)—Tighten the front bearing retainer nut lock screw at the front of the housing.

(15)—To assemble the differential, press the differential bearing in place. (16)—Install the side gear thrust washer and side gears in the case. (17)—Mesh the differential pinions with the side gears, holding the thrust washers on the back of the gears. (18)—Rotate the side gears until the holes through the center of the pinions are in line with the hole for the pinion shaft in the case. (19)—Press the pinion shaft in place. (20)—Locate the differential case in the carrier. (21)—Install the differential bearing caps and adjusting nuts. (22)—Draw up on the adjusting nuts until the marks show that the bearings are in their original position. (23)—Then tighten the screws in the bearing caps. The backlash should be .006" to .010". (24)—If an adjustment is necessary, tighten the differential adjusting nuts with sufficient force to drive the bearing cups against the shoulders on the differential case. (25)—Back off the adjusting nuts to relieve strain and then tighten them again slightly against the bearing cup. The assembly should rotate with a slight drag when turning the ring gear by hand. The assembly must not spin. (26)—Insert the thrust screw in the side of the carrier housing and turn it in until it strikes the ring gear. (27)—Back it off $\frac{1}{3}$ turn and lock it in position with the lock nut. This gives about .030" clearance.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

(28)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (29)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (30)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (31)—Install the axle shafts, being sure that the tapered dowels are in place on all studs, then tighten the stud nuts securely. NOTE—When the flange nuts are drawn up tight, there should always be a slight clearance between the lock washer and the flange. No clearance at this point indicates excessive wear on the studs, flange holes or tapered dowels. (32)—Complete the assembly by installing the universal flange and propeller shaft.

GROUP No. 126

Fig. 168

MACK RA-17, RA-22, RA-36, RA-45

DISASSEMBLE

(1)—Disconnect the propeller shaft from the pinion shaft flange, marking the flanges so that they may be assembled in their original position. (2)—Remove the axle shaft flange nuts and pull out the axle shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which the hubs may be removed. (4)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly. (5)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (6)—Remove the differential bearing cap screws and lift off the caps. (7)—Loosen the thrust block lock screw on the side of the differential carrier. (8)—Lift out the differential and ring gear. (9)—If it is necessary to remove the ring gear, remove the bolts which hold the ring gear to the differential case. (10)—Press the ring gear off the differential case. (11)—If the differential bearings are to be replaced, they can be removed from the differential case with a suitable bearing puller. (12)—Mark both halves of the differential case so that they can be assembled in their original position and remove the nuts which holds the differential case bolts. (13)—Remove the bolts after which the differential parts can be removed by hand. (14)—Remove the cotter pin, nut and lock washer from the front of the pinion shaft and with a puller remove the universal joint flange. (15)—Remove the pinion bearing cap screws and remove the cap and oil seal. (16)—The drive pinion and bearings can now be removed from the carrier. (17)—If the pinion or bearings are to be replaced, the pinion can be pressed out of the bearings. (18)—Collect the shims between the bearing cup flange

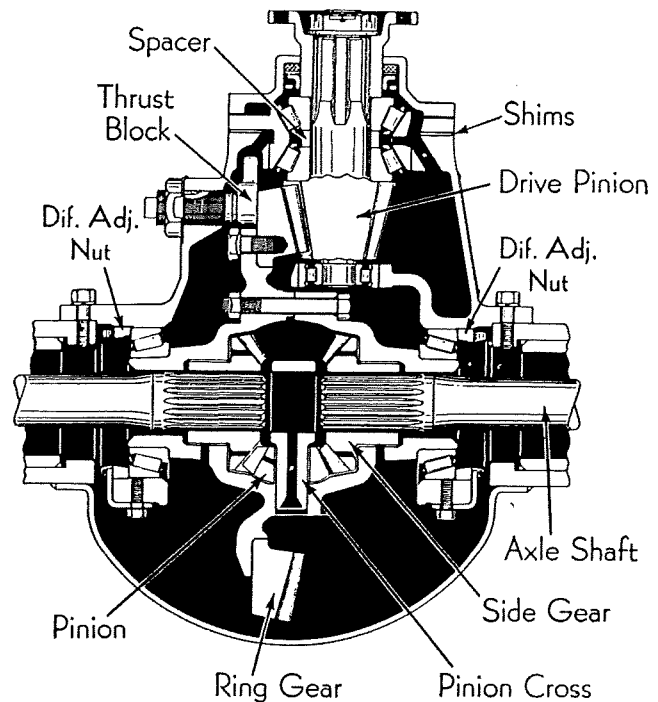


Fig. 168—Group No. 126 Rear Axle

and the end of the carrier and note the thickness so that the original thickness of shims will be used when the parts are reassembled. (19)—The rear roller bearing may now be removed from the pinion shaft.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks.

(2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced.

(3)—The bronze thrust block is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain from .010" to .012" clearance under no load.

(4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts, being sure to assemble the tapered dowels in the stud ends, and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced.

(5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts.

(6)—Check the differential case flange for runout by bolting the two halves of the case together and mount the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced.

(7)—Bolt the ring gear to the differential case flange and take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Press the rear bearing cone on the pinion shaft. (2)—Assemble the pinion to the bearing cup and then install the bearing spacer and the front bearing cone on the pinion shaft. (3)—Tighten the companion flange in place. This cone is a snug sliding fit to permit its movement when making adjustments. No end play should be allowed at these bearings. They should be from .000" to .002" tight, which can be felt as a slight drag when turned by hand. (4)—Play can be taken up by grinding down the spacer between the bearing cones or by installing a shorter spacer and shims. (5)—Assemble the differential case, using new thrust washers and lubricate all parts before assembling them. (6)—Before bolting the halves of the differential case together, be sure to align the marks which were made before the case was disassembled. (7)—After the case is securely fastened, be sure to lock the nuts in place. (8)—Lubricate the differential bearings and press them on the differential case. (9)—Assemble the drive pinion and bearings to the carrier housing, using the original shims between the bed of the carrier and the bearing cup flange. (10)—Replace the bearing cap and oil seal and tighten the companion flange in place, using a cotter pin in the nut to hold it in position. (11)—Assemble the differential and bearings assembly in the carrier housing. (12)—Replace the bearing adjusting nuts and the bearing caps, and tighten the caps in position. (13)—Turn the adjusting nuts until the marks on them indicate that they are in their original position. (14)—Then tighten the bearing cap screws and adjusting screw locks. There should be no play in the differential bearings. (15)—If an adjustment is necessary, tighten the bearing adjusting nuts with sufficient force to seat the bearing cups solidly against the rollers. (16)—Back off the adjusting nuts to relieve strain and tighten them again slightly against the bearing cups. (17)—Loosen the right adjusting nut and tighten the left nut, at the same time turning the ring gear, until all lash is removed. (18)—Then back off

the left nut one turn. (19)—Tighten the right nut until it is snug and continue for one or two more notches, until a locking position is reached.

(20)—Check the tooth contact and if it is necessary to move the ring gear away from the pinion, tighten the right nut and loosen the left nut an equal number of notches until the contact is correct. (21)—If the ring gear must be moved toward the pinion, tighten the left nut and loosen the right nut an equal number of notches. (22)—By turning both nuts the same amount, the bearing play will not be changed. (23)—The pinion can be moved toward or away from the ring gear by changing the thickness of the shims between the pinion bearing cup flange and the end of the carrier. (24)—Adding shims moves the pinion away from the ring gear and reducing the thickness of the shims moves the pinion toward the ring gear.

(25)—When this adjustment is completed, turn the thrust block screw in until it contacts the ring gear and then back it off just slightly. The clearance between the ring gear and the thrust block should be .010" to .012".

(26)—Assemble the carrier to the housing, using a new gasket and tighten the cap screws securely, using new lock washers under the screws. (27)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (28)—Adjust the bearings by tightening the bearing adjusting nuts until the wheel binds and then back them off just enough to permit the wheel to turn freely without end play. (29)—Install the axle shafts and tighten the flange nuts securely. (30)—Complete the assembly by attaching the universal joint flanges.

GROUP No. 127

Fig. 169

INTERNATIONAL 1936-1942

Models K-3, D15, C15, HDR-60, R-1100, R-1101

DISASSEMBLE

(1)—Disconnect the propeller shaft flange from the pinion shaft flange.

NOTE—Mark the flanges so they may be assembled in the original position. (2)—Unscrew the axle shaft nuts and pull out the shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the nuts and washers, after which, the hubs may be removed. (4)—Take off the differential inspection cover. (5)—Remove the cap screws which fasten the differential carrier assembly. (6)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembling, the approximate adjustment will be readily obtained, then remove the bearing caps. (7)—Remove the differential lock screw and pull out the shaft; the differential parts are now loose and can be

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

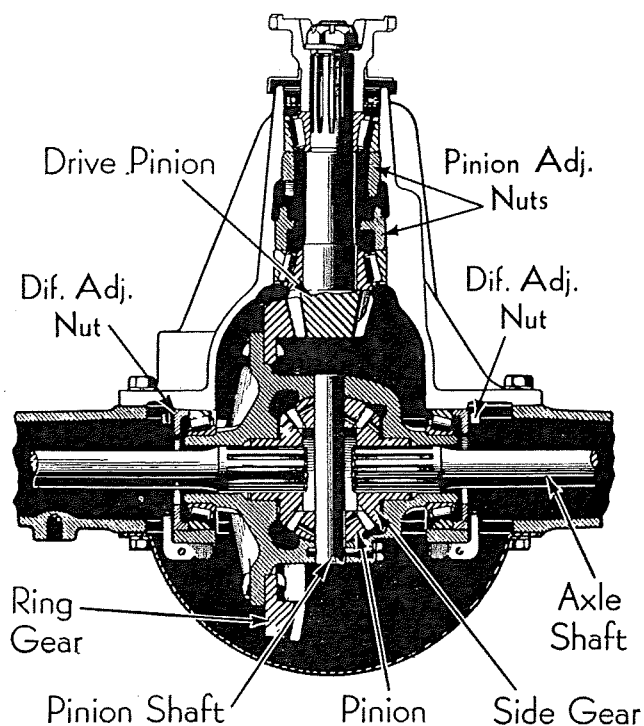


Fig. 169—Group No. 127 Rear Axle

removed by hand. (8)—If the ring gear is riveted to the flange, use a drill which is smaller in diameter than the rivet head and drill the rivets from the differential case side, then punch them out. (9)—Remove the pinion flange retaining nut and pull off the flange. (10)—Remove the pinion adjusting nut lock and loosen the adjusting nuts. (11)—Press the pinion shaft through the inside of the carrier, bringing the inner bearing along with it. (12)—Remove the front bearing from the housing and, if the bearing cups are to be removed, use a suitable puller. (13)—The adjusting nuts can now be screwed out of the housing through the inside—the inner nut first.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced. (3)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (4)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment

should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts. (5)—Check the differential case flange for runout by mounting the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced. (6)—After the ring gear is attached to the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Screw the adjusting nuts into the carrier, the outer nut first. (2)—Press the bearing cups in place. (3)—Assemble the rear bearing on the pinion shaft and push the pinion into the carrier from the inside. (4)—Install the front bearing and assemble the pinion shaft flange, fastening it securely with the retaining nut.

NOTE—Pinion adjustments cannot be made until after the differential is installed. (5)—Lubricate the differential pinions, side gears and thrust washers and install them in the differential case, then push in the pinion shaft, lining up the hole in the shaft with the hole in the case, after which, install the lock pin. (6)—Locate the differential case in the carrier and install the bearing caps and adjusting nuts, tightening the cap screws until the lock washers just flatten out.

NOTE—If new parts were installed or an adjustment is necessary, the adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. Then back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cup. (7)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (8)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. (9)—Screw the pinion shaft inner bearing adjusting nut against the inner bearing until the proper tooth contact is established between the ring gear and pinion. (10)—Now screw the outer bearing adjusting nut against the outer bearing until a slight drag is felt when turning the pinion by hand. (11)—When adjustments are satisfactory, install the adjusting nut lock. (12)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .006" to .010". If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If the backlash is less than specified, loosen the

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

left nut one notch and tighten the right nut one notch. Now tighten the bearing cap lock screws securely and recheck the lash. When correct, install the adjusting nut locks and lock the adjustment. (13)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (14)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (15)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (16)—Install the axle shafts and tighten the stud nuts securely. (17)—Complete the assembly by connecting the propeller shaft.

GROUP No. 128

Fig. 170

INTERNATIONAL

Model 708

DISASSEMBLE

(1)—Disconnect the propeller shaft from the pinion shaft flange. NOTE—Mark the flanges so they may be assembled in the original position. (2)—Unscrew the axle shaft nuts and pull out the shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which, the hubs may be removed. (4)—Take off the differential inspection cover. (5)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly. (6)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembling, the approximate adjustment will be readily obtained, then remove the bearing caps. (7)—Remove the differential shaft lock screw and push out the shaft. (8)—All the differential parts are now loose and can be removed by hand. (9)—If the ring gear is to be replaced, use a drill which is smaller in diameter than the rivet head and drill the rivets from the differential case side, then punch them out. (10)—Unscrew the flange nut from the end of the pinion shaft and pull off the flange. (11)—Press the pinion shaft out of the housing, bringing the inner bearing along at the same time. (12)—Remove the oil seal and the pinion outer bearing. (13)—Remove the pinion bearing cage lock bolts and unscrew the cage check nut, after which, the cage may be screwed from the housing.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced.

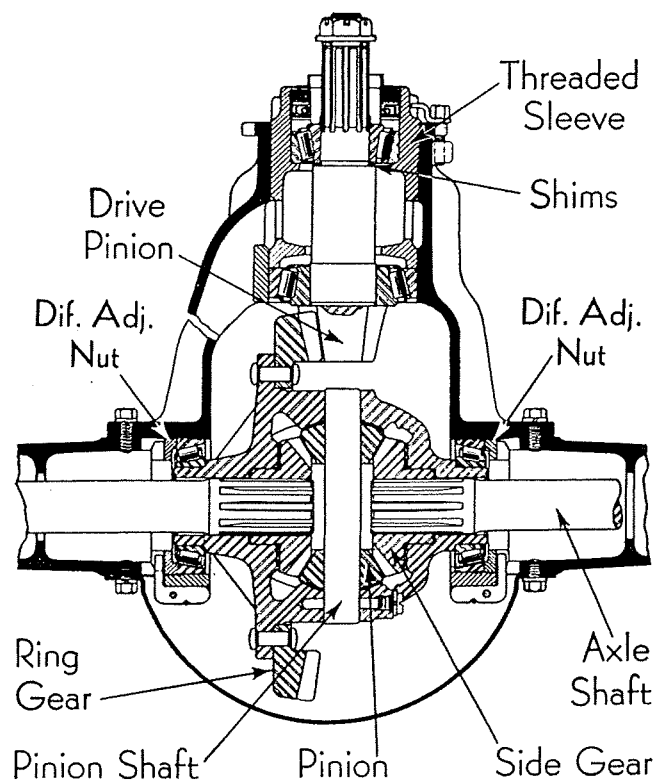


Fig. 170—Group No. 128 Rear Axle

(3)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced.

(4)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts.

(5)—Check the differential case flange for runout by mounting the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced.

(6)—After the ring gear is attached to the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Screw the pinion bearing cage into the housing. (2)—Press the inner bearing on the pinion shaft, replacing any shims which may have been under the bearing. (3)—Assemble the pinion shaft and inner bearing into the housing. (4)—Place the mud slinger and a new oil seal over the hub of the pinion flange and assemble the flange on the shaft, fastening the retaining nuts securely. (5)—Screw the bearing cage in or out as required to obtain a slight drag on the bearing when the pinion is turned by hand. (6)—After the desired result is obtained, replace the bearing cage check nut, being sure the bearing adjustment has not been disturbed, then install the bearing cage cap screws and locks. (7)—Lubricate the differential side gears, pinions and thrust washers and assemble these parts in the differential case. (8)—Push in the differential shaft, lining up the hole in the shaft with the hole in the case, then install the lock screw. (9)—Locate the differential case in the carrier and install the bearing caps and adjusting nuts, tightening the cap screws until the lock washers just flatten out. NOTE—If new parts were installed or an adjustment is necessary, the adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. Then back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cup. (10)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (11)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. NOTE—The endwise adjustment of the pinion shaft is controlled by shims under the inner bearing. If it is necessary to change the tooth contact between the ring gear and pinion, these shims are available in several thicknesses. Adding shims under the bearing moves the pinion toward the ring gear, and removing shims, moves the pinion away from the ring gear. (12)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .006" to .010". If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. Now tighten the bearing cap lock screws securely and recheck the lash. When correct, install the adjusting nut locks and lock the adjustment. (13)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (14)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (15)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then

back off just enough to permit the wheel to turn freely, yet without end play. (16)—Install the axle shafts and tighten the stud nuts securely. (17)—Complete the assembly by connecting the propeller shaft, lining up the marks which were made on the flanges before disassembly.

GROUP No. 129

Fig. 171

INTERNATIONAL 1935-1937

Model C-35, 732H

DISASSEMBLE

(1)—Disconnect the propeller shaft flange from the pinion shaft flange. NOTE—Mark the flanges so they can be assembled in the original position. (2)—Unscrew the axle shaft flange nuts and pull out the shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which, the hubs may be removed. (4)—Take off the differential inspection cover. (5)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly. (6)—Back out the thrust block adjusting screw to allow the drive gear to clear the thrust block when removing the differential assembly. (7)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembling, the approximate adjustment will be readily obtained, then remove the bearing caps. (8)—Mark both halves of the differential case so that when assembled, the original position is maintained, then unscrew the nuts which attach both halves of the case, after which, the case may be separated and all the differential parts removed. (9)—If the ring gear is to be replaced, use a drill which is smaller than the diameter of the rivet head and drill the rivet from the differential case side, after which, punch out the rivets. (10)—Remove the bearing cage cap screws and pull the drive pinion and bearing cage assembly out of the carrier. (11)—Clamp the pinion or universal flange in a vise and remove the flange retaining nut, after which, the flange, oil seal cover, outer spacer, front roller bearing, inner spacer and bearing cage may be removed.

NOTE—Collect the shims under the bearing cage, noting the quantity and thickness in order to facilitate adjustment when assembling. (12)—The rear roller bearing may now be removed from the pinion shaft.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced. (3)—The thrust block

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

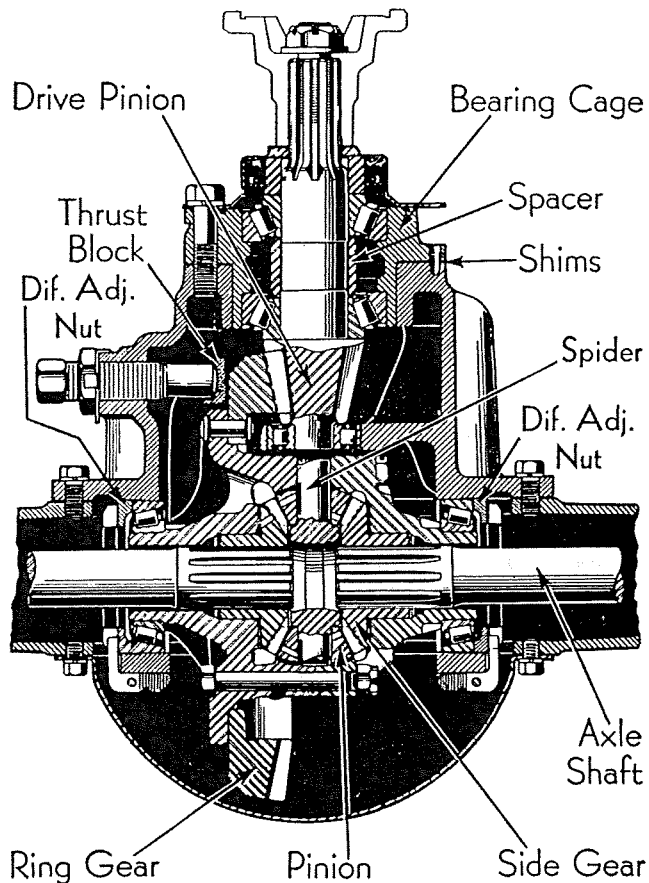


Fig. 171—Group No. 129 Rear Axle

is used to take any excessive side thrust on the ring gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain from .015" to .020" clearance. (4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should not be more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts. (6)—Check the differential case flange for runout by bolting the two halves of the case together and mount the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced. (7)—After the ring gear is attached to

the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. If within the specified limits, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it is an indication that the ring gear is not properly mounted on the flange.

ASSEMBLE

(1)—Press the rear tapered bearing on the pinion shaft and install the inner bearing spacer. (2)—Slip the bearing cage on the shaft and assemble the front tapered bearing and outer spacer in place. (3)—Install a new oil seal in the cover and place the seal and cover assembly over the outer spacer, after which, install the spacer washer and flange on the pinion shaft, fastening the retaining nut securely. (4)—When properly adjusted, the pinion bearing cap should turn freely but not spin on the shaft.

NOTE—If the cage turns too freely, or if end play is evident, it can be eliminated by the use of different thickness spacers. It is recommended that a dial indicator be used to determine the correct spacers to use. Be sure to lubricate the bearings thoroughly before assembling the pinion. (5)—Assemble the differential case, using new thrust washers, and lubricate all parts before assembling.

NOTE—Before bolting the halves of the differential case together, be sure to align the marks which were made before the case was taken apart. After the case is fastened securely, run locking wire through the bolt heads. (6)—Lubricate the differential bearings and place them in position on the hubs of the case. (7)—Assemble the drive pinion assembly in the carrier, replacing the original quantity of shims temporarily. (8)—Assemble the differential assembly in the carrier and install the bearing caps and adjusting nuts, drawing the nuts up until the marks which were made on the nuts and caps before disassembly are in the original position, then tighten the cap screws until the lock washers just flatten out. (9)—If new parts were installed or an adjustment was necessary, tighten the differential bearing adjusting nuts with sufficient force to seat the bearing cups solidly against the rollers. (10)—Back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cups. (11)—Loosen the right adjusting nut and tighten the left nut—at the same time turning the ring gear—until all lash is removed, then back off the left nut one turn. (12)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached.

NOTE—The endwise adjustment of the drive pinion is controlled by shims under the bearing cage. If it is necessary to change the tooth contact between the ring gear and pinion, these shims are available in several thicknesses. Adding shims under the cage moves the pinion away from the ring gear while removing shims moves the pinion toward the ring gear. (13)—Mount a

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .006" to .010". (14)—If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If less than specified, loosen the left nut one notch and tighten the right nut one notch. (15)—When the correct lash is established, tighten the bearing cap lock screws securely and recheck the backlash. If correct, install the adjusting nut locks and lock the adjustment. (16)—When the adjustments are completed, turn the thrust block adjusting screw all the way in to be sure the thrust block is seated on the end of the screw. (17)—Back off the screw and then tighten it again until the block contacts the ring gear. (18)—Finally, back off the screw from 1/6 to 1/4 turn and tighten the lock nut. (19)—Assemble the carrier to the housing, using new gaskets under the inspection cover and carrier, and fasten the cap screws securely, using new lock washers under the cap screws. (20)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (21)—Adjust the bearings by tightening the bearing adjusting nuts until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (22)—Install the axle shafts and tighten the stud nuts securely. (23)—Complete the assembly by attaching the propeller shaft flange to the pinion shaft flange, lining up the marks which were made before disassembly.

GROUP No. 130

Fig. 172

INTERNATIONAL 1933-1942

Models K1, K2, D1, D2, D5, C1, C5,
R-56-H, R-1000, R-1001

DISASSEMBLE

(1)—Disconnect the propeller shaft flange from the pinion flange.

NOTE—Mark the flanges so they may be assembled in the original position. (2)—To remove the axle shafts, take off the wheel and unscrew the nut from the end of the shaft. (3)—Remove the hub and brake drum assembly with a suitable puller.

NOTE—Do not use a "knock-off" type puller, or strike the end of the shaft to loosen the hub, because damage to the differential parts will very likely result. (4)—Remove the stud nuts which hold the oil seal and brake support to the axle housing, then remove the oil seals, brake supports and shims.

NOTE—Keep the shims from each axle separate so the original adjustment will be maintained. (5)—Use a puller to remove the axle shaft and bearing assembly. (6)—Press the bearing from the shaft. (7)—Use a suitable puller to remove the oil seals from the housing. (8)—Take off the differential inspection

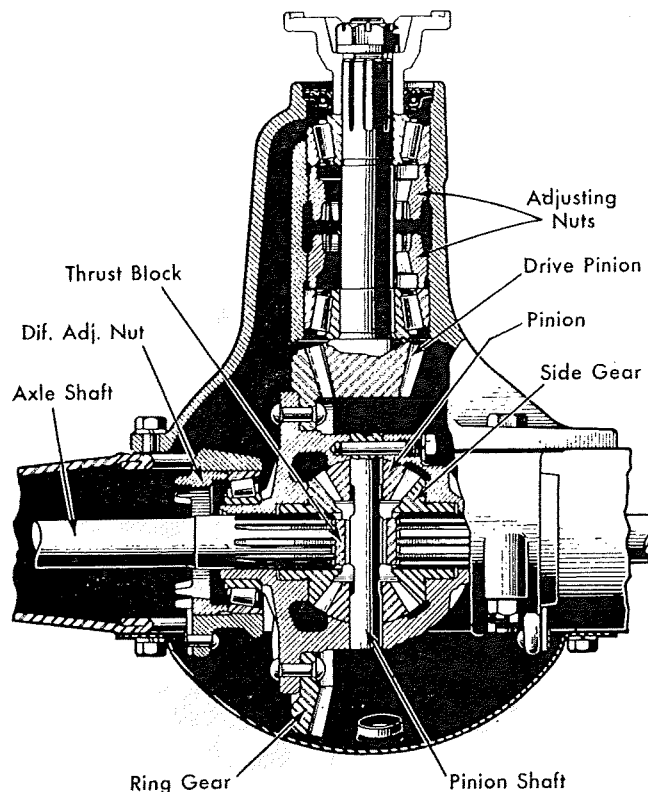


Fig. 172—Group No. 130 Rear Axle

cover. (9)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly. (10)—Mark the relationship of the differential bearing caps and adjusting nuts so that when assembled, the approximate adjustment will be readily obtained, then remove the bearing caps. (11)—Remove the differential lock screw and pull out the shaft—the differential parts are now loose and can be removed by hand. (12)—If the ring gear is riveted to the flange, use a drill which is smaller in diameter than the rivet head and drill the rivets from the differential case side, then punch them out. (13)—Remove the pinion flange retaining nut and pull off the flange. (14)—Remove the pinion adjusting nut lock and loosen the adjusting nuts. (15)—Press the pinion shaft through the inside of the carrier, bringing the inner bearing out at the same time. (16)—Remove the front bearing from the housing and, if the bearing cups are to be removed, use a suitable puller. (17)—The adjusting nuts can now be screwed out of housing through the inside—the inner nut first.

ASSEMBLE

(1)—Screw the adjusting nuts into the carrier—outer nut first. (2)—Press the bearing cups in place. (3)—Assemble the rear bearing on the pinion shaft and push the pinion into the carrier from the inside. (4)—Install the front bearing and assemble the pinion shaft flange, fastening it securely with the retaining nut.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

NOTE—Pinion adjustments cannot be made until after the differential is installed. (5)—Lubricate the differential pinions and side gears and install them in the differential case, then push in the shaft, lining up the hole in the shaft with the hole in the case, after which, install the lock screw. (6)—Locate the differential case in the carrier and install the bearing caps and adjusting nuts, tightening the cap screws until the lock washers just flatten out.

NOTE—If new parts were installed or an adjustment is necessary, the adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. Then back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing cup. (7)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (8)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. (9)—Screw the pinion shaft inner bearing and adjusting nut against the inner bearing until the proper tooth contact is established between the ring gear and pinion. (10)—Now screw the outer bearing adjusting nut against the outer bearing until a slight drag is felt when turning the pinion by hand. (11)—When the adjustments are satisfactory, install the adjusting nut lock. (12)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be from .006" to .010". If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. Now tighten the bearing cap lock screws securely and recheck the lash. When correct, install the adjusting nut locks and lock the adjustment. (13)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (14)—Install the axle shafts and bearings. (15)—Use a suitable drift to replace the oil seal.

NOTE—If the old parts are being used, and the shims have not been disturbed, the end play should be correct when the parts have been assembled. However, if a new axle shaft, bearing, differential carrier or axle housing has been installed, it will be necessary to check the end play. (16)—Check the end play after all the parts have been replaced except the wheel and hub. (17)—To make this check, tap each axle shaft—after tightening the bolts—to be sure the bearing cups are seated. (18)—Then place an indicator on the axle shaft and housing to determine the amount of end play, by pulling and pushing the shaft. (19)—If an adjustment is necessary, remove the axle shaft oil seal and brake support, then add or remove the required number of shims—which are located between the brake support and the outer face of the axle shaft flange.

NOTE—When making this adjustment, an equal thickness of shims should be added or removed on each side of the axle housing to maintain a central position of the axle shaft thrust lock. (20)—When the correct adjustment has been established, complete the assembly, and when connecting the propeller shaft, be sure the connection is made in line with the marks which were made before disassembly.

GROUP No. 131

Fig. 173

WHITE

Model RA 25C

DISASSEMBLE

(1)—Disconnect the propeller shaft from the pinion shaft flange, marking the flanges so that they may be assembled in their original position. (2)—Remove the axle shaft flange nuts and pull out the axle shafts. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nuts, washers and adjusting nuts, after which the hubs may be removed. (4)—Remove the cap screws which fasten the differential carrier to the axle housing and remove the carrier assembly. (5)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (6)—Remove the differential bearing cap screws and lift off the caps. (7)—Loosen the thrust block lock screw on the side of the differential carrier. (8)—Lift out the differential and ring gear. (9)—If it is necessary to remove the ring gear, remove the bolts which hold the ring gear to the differential case. (10)—Press the ring off the differential case. (11)—If the differential bearings are to be replaced, they can be removed from the differential case with a suitable bearing puller. (12)—Mark both halves of the differential case so that they can be assembled in their original position and remove the nuts which holds the differential case bolts. (13)—Remove the bolts after which the differential parts can be removed by hand. (14)—Remove the cotter pin, nut and lock washer from the front of the pinion shaft and with a puller remove the universal joint flange. (15)—Remove the pinion bearing cap screws and remove the cap and oil seal. (16)—The drive pinion and bearings can now be removed from the carrier. (17)—If the pinion or bearings are to be replaced, the pinion can be pressed out of the bearings. (18)—Collect the shims between the bearing sleeve flange and the end of the carrier and note the thickness so that the original thickness of shims will be used when the parts are reassembled. (19)—The rear roller bearing may now be removed from the pinion shaft.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

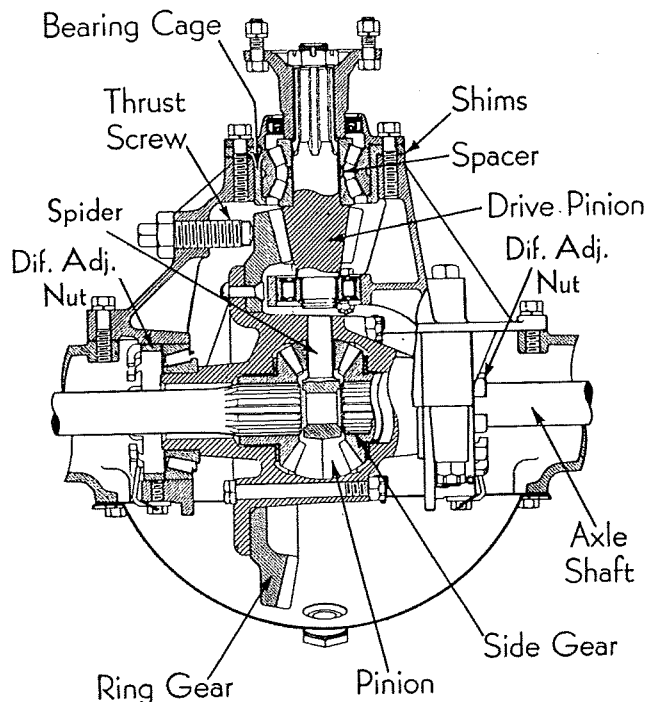


Fig. 173—Group No. 131 Rear Axle

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks.

(2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced.

(3)—The bronze thrust block is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain from .010" to .012" clearance under no load.

(4)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts, being sure to assemble the tapered dowels in the stud ends, and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced.

(5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts.

(6)—Check the differential case flange for runout by bolting the two halves of the case together and

mount the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced.

(7)—Bolt the ring gear to the differential case flange and take another reading with the dial indicator to be sure that the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Press the rear bearing cone on the pinion shaft. (2)—Assemble the pinion shaft to the bearing cup and sleeve and then install the bearing spacer and front bearing cone on the pinion shaft. (3)—Tighten the companion flange in place on the pinion shaft. The bearing sleeve is a snug sliding fit in the housing to permit its movement when making adjustments. (4)—Play can be taken up by grinding down the spacer between the bearing cones or by installing a shorter spacer and shims. (5)—Assemble the differential case, using new thrust washers and lubricate all parts before assembling them. (6)—Before bolting the halves of the differential case together, be sure to align the marks which were made before the case was disassembled. (7)—After the case is securely fastened, be sure to lock the nuts in place. (8)—Assemble the drive pinion and bearings with sleeve to the carrier, using the original shims between the end of the carrier and the sleeve flange. (9)—Assemble the drive pinion and bearings to the carrier housing, using the original shims between the bed of the carrier and the bearing cup flange. (10)—Replace the bearing cap and oil seal and tighten the companion flange in place, using a cotter pin in the nut to hold it in position. (11)—Assemble the differential and bearings assembly in the carrier housing. (12)—Replace the bearing adjusting nuts and the bearing caps, and tighten the caps in position. (13)—Turn the adjusting nuts until the marks on them indicate that they are in their original position. (14)—Then tighten the bearing cap screws and adjusting screw locks.

There should be no play in the differential bearings. (15)—If an adjustment is necessary, tighten the bearing adjusting nuts with sufficient force to seat the bearing cups solidly against the rollers. (16)—Back off the adjusting nuts to relieve strain and tighten them again slightly against the bearing cups. (17)—Loosen the right adjusting nut and tighten the left nut, at the same time turning the ring gear, until all lash is removed. (18)—Then back off the left nut one turn. (19)—Tighten the right nut until it is snug and continue for one or two more notches, until a locking position is reached.

(20)—Check the tooth contact and if it is necessary to move the ring gear away from the pinion tighten

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

the right nut and loosen the left nut an equal number of notches until the contact is correct. (21)—If the ring gear must be moved toward the pinion, tighten the left nut and loosen the right nut an equal number of notches. (22)—By turning both nuts the same amount, the bearing play will not be changed. (23)—The pinion can be moved toward or away from the ring gear by changing the thickness of the shims between the pinion bearing sleeve flange and the end of the carrier. (24)—Adding shims moves the pinion away from the ring gear and reducing the thickness of the shims moves the pinion toward the ring gear.

(25)—When this adjustment is completed, turn the thrust block screw in until it contacts the ring gear and then back it off just slightly. The clearance between the ring gear and the thrust block should be .010" to .012".

(26)—Assemble the carrier to the housing, using a new gasket and tighten the cap screws securely, using new lock washers under the screws. (27)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting the nuts, using new oil seals. (28)—Adjust the bearings by tightening the bearing adjusting nuts until the wheel binds and then back them off just enough to permit the wheel to turn freely without end play. (29)—Install the axle shafts and tighten the flange nuts securely. (30)—Complete the assembly by attaching the universal joint flanges.

GROUP No. 132

Fig. 174

WHITE

Model RA-20C

(1)—To remove the axle shaft, remove the axle drive flange screws. (2)—Pull out the shaft. (3)—Straighten the tabs on the wheel bearing lock washers and remove the lock nut, washer and adjusting nut, after which the hub may be removed. (4)—Remove the cap screws which hold the differential carrier assembly to the axle housing. (5)—Lift out the differential carrier. (6)—Before removing any parts, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that they can be assembled with approximately the same drive gear adjustment. (7)—Remove the differential bearing cap screws and lift out the caps. (8)—Lift out the differential and ring gear assembly. (9)—With a puller, remove the differential bearings. (10)—To disassemble the ring gear from the case, remove the lock wire and the screws which hold the ring gear in place. (11)—Press the ring gear off the differential case. (12)—Mark both halves of the differential case so that they can be assembled in their original position and remove the nuts from the differential case bolts. (13)—Remove the bolts, after which the differential parts can be removed

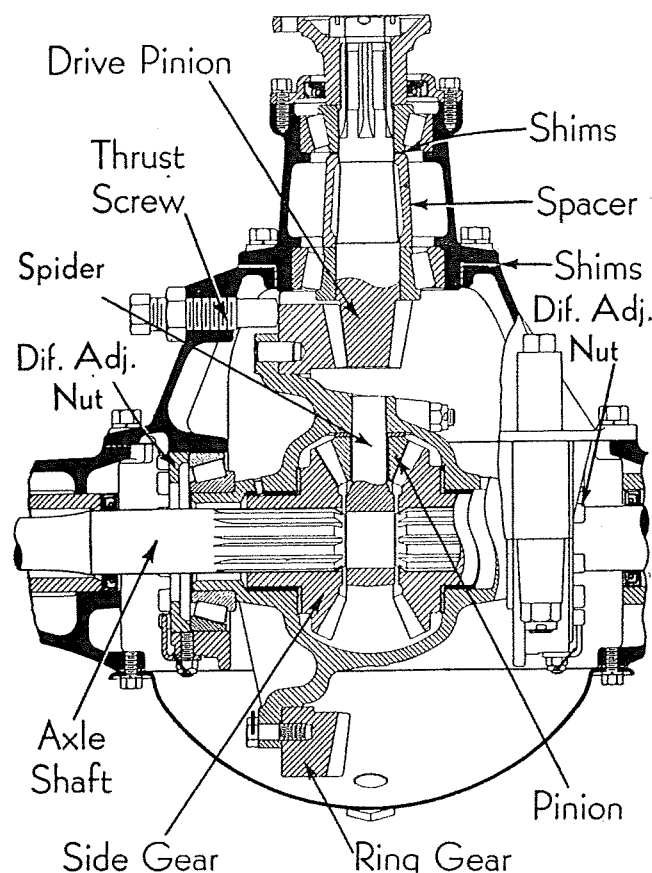


Fig. 174—Group No. 132 Rear Axle

by hand. (14)—Remove the cotter pin, nut and washer from the front of the pinion shaft and with a puller, remove the universal joint flange. (15)—Remove the pinion bearing cap screws and remove the cap and oil seal. (16)—Remove the bolts holding the pinion shaft housing to the differential carrier housing and lift out the pinion and its housing. (17)—If the pinion or bearings are to be replaced, the pinion can be pressed out of the bearings. (18)—If it is necessary to replace the pinion or the rear bearing the pinion can be pressed out of the rear bearing cone. (19)—Both bearing cups can be removed from the housing with a bearing puller. (20)—Loosen the ring gear thrust screw lock nut at the side of the carrier housing and remove the screw.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks. (2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced. (3)—The thrust screw is used to take any excessive side thrust on the drive gear, and when the assembly is completed, the adjusting screw should be turned in or out as required to obtain from .010" to .015" clearance under no load. (4)—Check the axle shafts by installing temporarily

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts, being sure to assemble the tapered dowels in the stud ends, and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced. (5)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts. (6)—Check the differential case flange for runout by bolting the two halves of the case together and mount the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced. (7)—Rivet the ring gear to the differential case flange and take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Press the rear bearing cone on the pinion shaft. (2)—Assemble the bearing cups in the pinion shaft housing, if they have been removed. (3)—Then install the pinion in its housing and slide the spacer and front bearing cone on the shaft. (4)—Replace the bearing cap and oil seal on the pinion housing and tighten its fastening screws. (5)—Then tighten the companion flange in place to take up play in the bearing. (6)—Assemble the differential case, using new thrust washers and lubricate all parts before assembling them. (7)—Before bolting the halves of the differential case together, be sure to align the marks which were made before the case was disassembled. (8)—After the case is securely fastened, be sure to lock the nuts in place. (9)—Lubricate the differential bearings and press them in the differential case. (10)—Assemble the drive pinion and housing to the differential carrier with a new gasket and tighten the bolts. (11)—Assemble the differential assembly and bearings in the carrier in the housing. (12)—Replace the bearing adjusting nuts and the bearing caps and tighten the caps in position. (13)—Turn the adjusting nuts until the marks on them indicate that they are in their original position. (14)—Then tighten the adjusting nut locks. There should be no play in the differential bearings. (15)—If an adjustment is necessary, tighten the bearing adjusting nuts with sufficient force to seat the bearing cups solidly against the rollers. (16)—Back off the adjusting nuts to relieve strain and tighten them again slightly against the bearing cups. (17)—Loosen the right adjusting nut

and tighten the left nut, at the same time turning the ring gear, until all lash is removed. (18)—Then back off the left nut one turn. (19)—Tighten the right nut until it is snug and continue for one or two more notches, until a locking position is reached. (20)—Check the tooth contact and if it is necessary to move the ring gear away from the pinion, tighten the right nut and loosen the left nut an equal number of notches until the contact is correct. (21)—If the ring gear must be moved toward the pinion, tighten the left nut and loosen the right nut an equal number of notches. (22)—By turning both nuts the same amount, the bearing play will not be changed. (23)—The pinion can be moved toward or away from the ring gear by shims between the differential carrier and the pinion shaft housing. (24)—Removing shims moves the pinion toward the ring gear and increasing the thickness of the shims moves the pinion away from the ring gear. (25)—When this adjustment is complete turn the thrust screw in until it contacts the ring gear and then back it off just slightly. The clearance between the ring gear and the thrust block should be .010" to .012". (26)—Assemble the carrier to the housing, using a new gasket and tighten the cap screws securely, using new lock washers under the screws. (27)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts. Use new oil seals. (28)—Adjust the bearings by tightening the bearing adjusting nuts until the wheel binds and then back them off just enough to permit the wheel to turn freely without end play. (29)—Install the axle shaft and tighten the flange nuts securely. (30)—Complete the assembly by attaching the universal joint flange.

GROUP No. 133

Fig. 175

WHITE HORSE

DISASSEMBLE

NOTE—The drive pinion shaft is integral with the transmission mainshaft and if the shaft is to be removed, see the TRANSMISSION, OVERHAUL chapter for instructions.

(1)—After removing the assembly from the chassis, remove the axle shaft flange nuts and pull out the shafts. (2)—Remove the wheel bearing nuts and washers and remove the hubs. (3)—Take off the differential inspection cover. (4)—Remove the cap screws which fasten the transmission case to the differential carrier and separate the two units. NOTE—Be sure to collect the shims which are located between these two housings as they control the relationship between the ring gear and pinion tooth contact. (5)—Remove the cap screws which fasten the carrier to the axle housing and withdraw the carrier. (6)—Remove the differential lock pin and pull out the differential shaft. (7)—All the differential parts are now loose and can be removed by hand. (8)—If the ring gear is to be

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

replaced, use a drill which is smaller in diameter than the rivet and drill the rivets from the differential case side, then punch them out.

INSPECTION

(1)—Clean the housing thoroughly and inspect all gears and bearings for wear, cracks, pits or score marks.

(2)—If the thrust washers which are used behind the differential side gears and pinions show evidence of wear, they should be replaced.

(3)—Check the axle shafts by installing temporarily the wheel bearings and hubs, drawing the bearing nuts up tight enough to permit the hubs just to turn. Install the axle shafts and tighten the nuts securely. Now turn the hub and observe whether or not the inner end of the shaft "wobbles." If the "wobble" or runout exceeds $\frac{1}{32}$ ", the shaft is sprung and should be replaced.

(4)—After making sure the axle shafts are not sprung, the axle housing may be checked by laying a straight edge along the splines of both axle shafts. The straight edge should lay in a horizontal plane and misalignment should be not more than $\frac{1}{32}$ "; if more than this amount, the axle housing is sprung and should be replaced. After making these checks, remove the axle shafts.

(5)—Check the differential case flange for runout by mounting the assembly in the carrier, adjusting the differential bearings just snug enough to obtain a true reading on the gear side of the flange with a dial indicator. If the flange runout is in excess of .002", the flange will have to be trued up in a lathe, or the differential case replaced.

(6)—After the ring gear is attached to the differential case flange, take another reading with the dial indicator to be sure the runout of the flange is not excessive. After making this check, check the runout of the ring gear with the dial indicator on the back face of the gear. If the runout exceeds .005", it indicates that the ring gear is not properly mounted to the flange.

ASSEMBLE

(1)—Lubricate the differential side gears, pinions and thrust washers and assemble these parts in the differential case. (2)—Push in the differential shaft, lining up the hole in the shaft with the hole in the case, then install the lock pin. (3)—Locate the differential case in the carrier and install the bearing caps and adjusting nuts, tightening the cap screws until the lock washers just flatten out. NOTE—If new parts were installed or an adjustment is necessary, the adjusting nuts should be tightened with sufficient force to drive the bearing cups solidly against the rollers. Then back off the adjusting nuts to relieve the strain and tighten them again slightly against the bearing

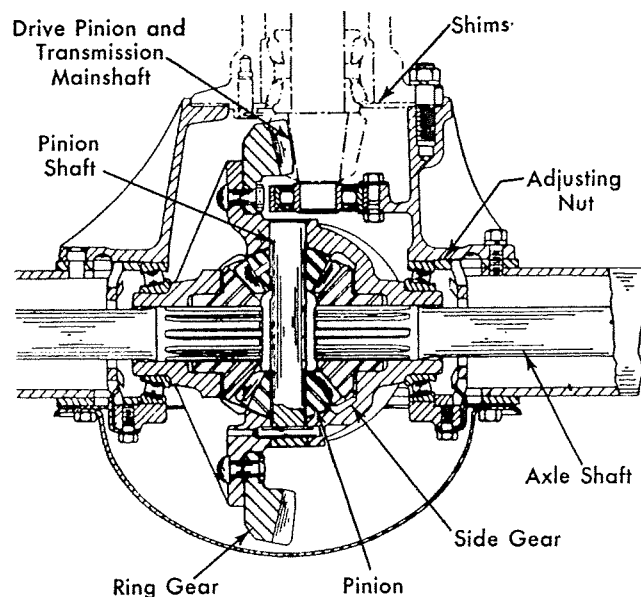


Fig. 175—Group No. 133 Rear Axle

cup. (4)—Now while turning the ring gear, loosen the right adjusting nut and tighten the left adjusting nut until all lash is removed and then back off the left nut one turn. (5)—Tighten the right adjusting nut until it is snug and continue for one or two notches more, or until a locking position is reached. (6)—Assemble the carrier to the transmission, installing the shims between the two housings and fasten the housings securely together. (7)—Check the relationship between the ring gear and pinion tooth contact and if the drive pinion is too deep in the ring gear, install the required thickness of shims between the two housings. Similarly, if the pinion is not deep enough, remove the necessary shims. When the correct tooth contact is established, check the backlash. (8)—Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, which should be about .010"-.012". If the backlash exceeds this amount, loosen the right adjusting nut one notch and tighten the left nut one notch. If the backlash is less than specified, loosen the left nut one notch and tighten the right nut one notch. Now tighten the bearing cap lock screws securely and recheck the lash. When correct, install the adjusting nut locks and lock the adjustment. (9)—Assemble the carrier in the axle housing, using a new gasket and lock washers under the cap screws, being sure to draw up the cap screws evenly and securely. (10)—Lubricate the wheel bearings and assemble the hubs, bearings and adjusting nuts, using new oil seals. (11)—Adjust the bearings by tightening the adjusting nut until the wheel binds, then back off just enough to permit the wheel to turn freely, yet without end play. (12)—Install the axle shafts and tighten the stud nuts securely.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

GROUP No. 134

PAK-AGE-CAR

NOTE—If repairs are to be made to the transmission, see the TRANSMISSION, OVERHAUL chapter for instructions.

DISASSEMBLE

(1)—Remove the rear axle and power plant assembly from the chassis. (2)—Unscrew the wheel shaft nuts and pull off the hub and brake drum assemblies. (3)—Unfasten the spring from the transmission case and from the wheel supports. (4)—Disconnect the radius rods from the wheel supports. (5)—The wheel supports and wheel shafts may then be removed from the outer universal joints. (6)—Pull the drive shaft assemblies out of the differential. (7)—Disconnect the clutch housing from the engine and separate the transmission and differential assembly from the engine. (8)—Disconnect the clutch housing from the transmission housing. (9)—Remove the cap screws from the differential bearing caps and remove the caps, shims and bearings.

NOTE—Keep these shims separate so that when assembling, the approximate ring gear and pinion backlash adjustment will be readily obtained. (10)—Remove the differential assembly from the housing. (11)—Take out the differential shaft lock screw and push out the shaft. (12)—All the differential parts will now be loose and can be removed by hand. (13)—If the ring gear is to be replaced, remove the cap screws and tap the gear from the differential case flange. (14)—Unscrew the nut from the end of the pinion shaft and remove the pinion shaft driven gear.

NOTE—Collect the shims which are located between the drive gear and bearing. These shims control the endwise adjustment of the pinion with relation to the ring gear. (15)—Press the pinion shaft out of the housing and remove the bearing.

ASSEMBLE

Assembly is made in the reverse order, being sure to lubricate all bearings, gears and thrust washers before installation. New oil seals should also be installed.

NOTE—After the differential is installed in the housing, check the tooth contact between the ring gear and pinion. If the pinion is to be moved away from the ring gear, the necessary thickness of shims must be removed from between the pinion driven gear and the pinion bearing. If the pinion is to be moved toward the ring gear, the required thickness of shims should be installed at this point. The backlash between the pinion and the ring gear should be .008" to .012". If it is less than .008", remove shims from between the left differential bearing cone and the retainer and install the same thickness of shims between the right differential bearing, cone and the retainer until the cor-

rect backlash is obtained. If the backlash is in excess of .012", remove shims at the right bearing and add the same thickness at the left bearing. The final check should be made with the differential bearing cap retaining screws securely tightened. To move the ring gear away from the pinion, remove shims from the left differential bearing and add the same thickness to the right bearing. To move the ring gear toward the pinion, remove shims from the right differential bearing and add the same thickness to the left bearing.

GROUP No. 135

Fig. 176

EATON 2-SPEED AXLE

DISASSEMBLE

(1)—To remove the axle shaft, remove the axle drive flange screws. (2)—Pull out the shaft. (3)—Straighten

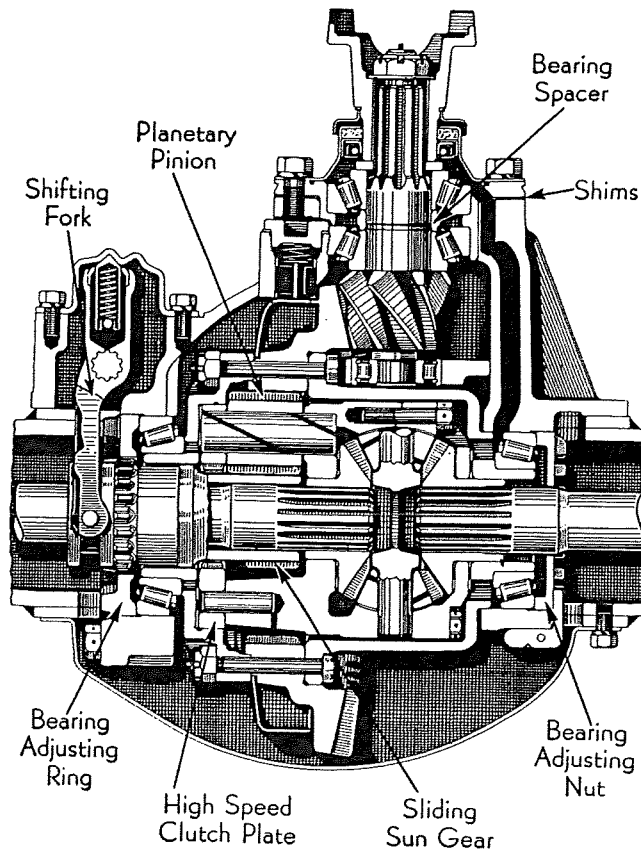


Fig. 176—Group No. 135 Two-Speed Axle

the tabs on the wheel bearing, lock washers and remove the lock nut, washer and adjusting nut, after which the hub may be removed. (4)—Remove the cap

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

screws which hold the differential carrier assembly to the axle housing. (5)—Disconnect the shift rod. (6)—Lift out the differential carrier. (7)—For convenience in handling, the head may be placed in the end of a clean small keg or drum. The opening should be large enough to accept the bevel drive gear and bearing caps so that the unit rests on the flange of the differential carrier casting. (8)—Remove the plug, washer, spring, cap screw, lock washer and oil distributor from the side of the housing. (9)—Remove the cap screws in the shift fork cover, noting the special screw in the off-center hole. (10)—Lift off the shift fork and gasket. (11)—Pull out the shift fork shaft. (12)—The shift fork may then be slipped from the sliding clutch gear and removed through the back of the differential carrier. (13)—Slip out the sliding clutch gear. (14)—Mark the right differential bearing adjusting nut so that it can be reassembled in its original position. (15)—Remove the differential carrier bearing cap bolt lock wire on both sides. (16)—Loosen the cap bolts and remove the right bearing adjusting nut, lock and cotter pin. (17)—Remove the left differential bearing cap adjusting nut and lock as an assembly to assure correct positioning of the gear when reassembling. (18)—After removing the bearing caps, tip up the left end of the planetary unit and lift it out. (19)—Remove the pinion bearing cage cap screws. (20)—Use a ball-peen hammer to drive out the pinion assembly, noting the thickness of the shims under the bearing cage. (21)—Check for end play in the bearings before disassembly. (22)—Take out the cotter pin, loosen the pinion shaft nut and slide off the companion flange. (23)—Lift off the pinion bearing cage, bearing and washer. (24)—Slip off the pinion bearing spacer. (25)—Drive off the pinion bearing cage by tapping between the teeth of the pinion alternately on opposite side of the inner race. (26)—Remove the pinion bearing cage and washer from the cage assembly. (27)—Take out the pinion bearing cage cork gasket. (28)—Remove the lockwire from the support case bolts. (29)—Unscrew the support case bolt nuts and remove the bolts. (30)—Tap alternately on opposite sides of the ring gear with the head of a rawhide hammer until the gear is free of the flange on the support case. (31)—Lift off the left support case, thrust washer and bevel drive gear. (32)—Pry off the high-speed clutch plate, take out the idler pinions and pins. (33)—Lift off the differential assembly. (34)—Remove the support case thrust washer. (35)—Take out the differential case bolt lockwire and remove the bolts, noting the short bolts between the spider arms. (36)—Lift off the right differential case. (37)—Pick up the long hub side gear on the right side and slip off the thrust washer. (38)—Pull out the spider and differential side pinions, noting the thrust washers behind the pinions. (39)—Slip the washers and pinions off the spider arms. (40)—Take out the short-hub gear on the left side and remove the thrust washer. (41)—Remove the differential bearing cones by striking the inner race on alternate sides through holes provided in the support case.

ASSEMBLE

(1)—Follow the steps described for disassembling the unit in the reverse order to assemble the unit. Take the following precautions: (a)—When assembling the differential unit, lubricate both sides of all thrust washers well. The chamfered sides of the washers must be against the back face of the side gears. As assembled, lubricate the spider arms, side pinion bores and side gear hubs. Draw bolts tight with long-handled wrench and securely fasten them with a lockwire. (b)—When assembling the planetary unit, lubricate both sides of the thrust washers well and cover the idler pins with lubricant. The chamfered teeth on the high speed clutch plate must face the pinions. Place the notches in the oil collector drum between the bolt holes in the bevel gear. Draw the bolts tight with a long-handled wrench and lock them with a wire. (c)—After assembling the inner pinion bearing, stake over the pinion shaft in four spots. A bearing ball can be pressed against this point to do this. (d)—The pinion shaft bearing is adjusted by using a spacer of the correct thickness between the bearing inner races. Twelve spacers of different thicknesses are available for this purpose. To make an adjustment, place the pinion and bearings in position in the case, using the original spacer providing the pinion did not have any perceptible end movement before disassembly. Then assemble the flange washer and flange. Tighten the retaining nut securely. There should be no end play and the bearings should roll freely. If an adjustment is to be made, select the proper size spacer. (e)—When assembling the differential carrier unit, lubricate all bearings as they are assembled in the carrier. See that the dowel in the pinion cage is inserted in the dowel hole in the carrier. When assembling the left differential bearing cap adjusting nut, hold the adjusting nut and bearing cap up away from the threads in the bore of the carrier until the cap bolts are started. Drop the cap. The threads of the adjuster and those in the carrier will mesh freely. Start the cap bolts before dropping the bearing caps in place. After adjusting the gears be sure the cap bolts are very tight. Wire the bolts securely, including the cap screws in the adjusting nut lock.

TOOTH CONTACT ADJUSTMENT

(1)—The pinion is adjusted for tooth contact by shims between the bearing cage flange and the carrier on axles where back to back taper roller bearings are used. On axles where double row ball bearings are used, as on Chevrolet, no adjustment is provided. (2)—If an adjustment is possible, install the pinion and bearing cage assembly, using the same thickness of shims as were originally fitted. (3)—Tighten only two bolts until the correct setting is obtained. (4)—With the pinion in position, assemble the differential and bevel gear unit and bring the gear up to the position

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

where the backlash is from .006" to .010". (5)—Be sure that the differential bearing cups are properly seated on the rollers. (6)—Check the tooth contact and make the adjustments as already described. (7)—After the settings are completed, be sure the differential bearings are up tight. A light preload of $1\frac{1}{2}$ to 2 notches on the right adjusting nut is desired. (8)—After the carrier is assembled in the chassis, make the final check. (9)—Jack up one wheel and paint the gear teeth. (10)—Place the axle in high axle ratio position and apply light brake load with the engine for a few revolutions, with the transmission in low and reverse. See if the contact checks fairly well with the bench setting. It is to be expected that the lengthwise bearing will lengthen out a little, particularly towards the heel.

GROUP No. 136

Fig. 177

CHEVROLET 2-SPEED AXLE

G. M. C. 2-SPEED AXLE

(TIMKEN)

DISASSEMBLE

(1)—To remove the axle shaft, bend the lugs of the lock plate away from the bolt heads at the outer end of the axle shaft. (2)—Remove the cap screws and lock plate. (3)—Pull out the axle shaft and gasket.

(4)—To remove the wheel bearings, raise the lip of the lock from the notch in the lock nut. (5)—Remove the lock nut and remove the lock, inner adjusting nut and thrust washer. (6)—Remove the hub and drum assembly. (7)—Remove the inner bearing and oil seal with a suitable puller. (8)—To remove the outer bearing, first tap the outer race to relieve the tension at the snap ring. (9)—Then remove the snap ring on the inside of the hub. (10)—Remove the bearing by driving the outer race of the bearing by using a long $\frac{1}{8}$ " punch through the cap screw holes in the inner end of the hub. This will also bring out the inner race and roller assembly.

(11)—To remove the differential and carrier, remove the trunnion bearing lock rings and drive the trunnion bearings from place. (12)—Split the universal joint and let the propeller shaft drop down. (13)—Remove the cap screws which hold the differential carrier to the axle housing and lift out the carrier.

(14)—Place the assembly in a vise by clamping on the lower rib of the carrier. (15)—Remove the cotter pin, nut and washer from the end of the pinion shaft. (16)—The universal joint yoke may then be removed from the shaft. (17)—Before removing the differential from the carrier, mark both differential bearing adjusting nuts and caps to indicate on which side each is mounted and also its location in the carrier so that

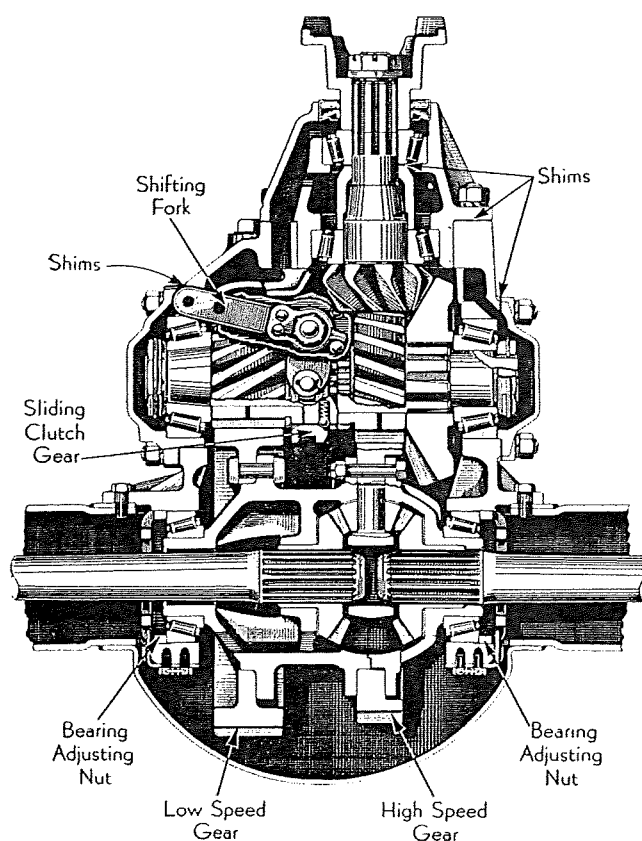


Fig. 177—Group No. 136 Two-Speed Axle

they can be assembled with approximately the same drive gear adjustment. (18)—Remove the tie wire, differential bearing adjusting nut locks and bolts from the bearing caps. (19)—Remove the bearing caps and differential assembly from the housing. (20)—To remove the pinion cage and bearing assembly, remove the nuts which retain the cage to the carrier. (21)—There are two tapped holes in the flange of the cage for use when removing a tight cage. (22)—When removing the pinion cage and the double reduction shaft bearing caps the number and the thickness of the shims should be noted so that the same thickness will be used when the unit is reassembled. This will save considerable time when making adjustments.

(23)—Remove the shifter lever retainer nut and lock washer. (24)—Then remove the lever, pawl and Woodruff key from the shifter yoke shaft. (25)—The bushing can be removed by raising it with a screwdriver through the notch provided in the carrier. The bushing must be removed to permit the removal of the double reduction shaft assembly. (26)—Remove the nuts and lock washers from the double reduction shaft bearing caps and remove the caps and shims. Note the thickness of the shims. (27)—A short bar can be used between the back of the ring gear and the carrier to aid in removing the left bearing cap which is piloted to the carrier.

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

(28)—The double reduction shaft assembly can now be removed from the carrier by sliding it to the left side of the carrier, and pulling the ring gear toward the rear, threading the assembly past the differential bearing supports. (29)—Then remove the shifter yoke. (30)—The right bearing outer race can be removed from the carrier with a soft drift punch and hammer. (31)—To disassemble the drive pinion, press the pinion shaft, rear bearing and spacer out of the pinion cage, using an arbor press. (32)—From the back end of the cage drive the oil seal out the front end, using a long punch or drift. Make a note of the thickness of the shims between the front bearing inner race and the front face of the spacer. (33)—With an arbor press and a bearing remover, press the rear pinion bearing off the shaft. (34)—Damaged bearing outer races can be removed from the pinion bearing cage with a bearing puller through the back end of the cage to drive the front race out. (35)—A drift or punch may be used through the front of the cage to drive the rear race out.

(36)—To disassemble the double reduction shaft assembly, remove the lock rings from the bearing nuts. (37)—The nut at the end opposite the ring gear should be removed first, to permit removal of the bearing, low-speed pinion, shifter sleeve and detent balls and springs. (38)—Then clamp the splined section of the double reduction shaft in a vise, fitted with copper jaws to protect the teeth, and remove the bearing nut from the ring gear end of the shaft. (39)—Replace the shifter sleeve on the shaft, allowing it to bear against the high-speed pinion. (40)—With the assembly resting on the shifter sleeve supported in an arbor press, press the bearing and ring gear from the shaft. (41)—To disassemble the differential, remove the lock wire and bolts from the differential case. (42)—Then remove the cover, high-speed double reduction gear, spider, differential pinions and the side gears. The low-speed double reduction gear is riveted to the case and is serviced as a unit with the case. The high-speed double reduction gear is serviced separately.

INSPECTION

(1)—Wash all parts in clean gasoline or other cleaning fluid. (2)—Then inspect the drive pinion for chipped, cracked, or worn teeth. (3)—Inspect the bearing races and rollers for pits and cracks. (4)—Inspect the ring gear and double reduction pinions for cracked or chipped teeth. (5)—Check the fit of the pinions on the shaft and inspect the bearings for damaged rollers or cracked races.

ASSEMBLE

(1)—To assemble the drive pinion, lubricate the bearing roller races. (2)—Install the rear pinion bearing on the drive pinion. (3)—Install the spacer on the shaft up against the bearing. (4)—Install the pinion, bearing and spacer in the pinion cage. (5)—Then install over the pinion shaft and up against the front face of the spacer inside the cage, the same number and thickness of shims as were removed. (6)—Press

the front pinion bearing on the shaft until stopped. This should produce a slight drag when turning the pinion cage. (7)—Should the cage turn too freely, or too hard, remove the front bearing and add or remove shims as necessary to produce the slight drag or proper adjustment. (8)—After arriving at the proper adjustment of the pinion bearings, install the spring loaded oil seal, with the open end of the leather to the rear, using a driver to support the front face of the seal to prevent damage. (9)—Install the joint yoke, nut and cotter pin.

(10)—Before assembling the double reduction shaft assembly, lubricate the inner bearing surfaces with light grease. (11)—Install the high-speed double reduction pinions on the shaft and start the ring gear on the splines. (12)—Then press the ring gear tightly on the shaft. (13)—Start the bearing on the shaft and place the outer race over it. (14)—Then support the outer race and press the bearing solidly against the ring gear. (15)—Place the splined section of the shaft in a vise equipped with copper jaws. (16)—Install the bearing retaining nut and tighten it. The nut must be in a locking position. (17)—The shifter sleeve has three tapered teeth in each side which work in connection with the detent lock balls in the shaft, and must line up with the springs and balls in the shaft. (18)—The tapered teeth in the shifter sleeve are unevenly spaced. Find the location for assembly by counting the number of teeth between the holes in the shaft and between the tapered teeth in the sleeve. The nine tooth spacings must go together. (19)—The tapered side of the shifter sleeve must be toward the ring gear. (20)—Install the springs and detent balls in the holes in the shaft. (21)—Compress the springs and install the shifter sleeve with its tapered side towards the high-speed pinion. (22)—Assemble the low-speed double reduction pinion to the shaft. (23)—Press the bearing on the taper, install its retaining nut and tighten it with a special wrench, until clearance between the pinion and the bearing inner race is from .012" to .015". (24)—Lock the nuts by installing the lock rings. (25)—Before assembling the differential, lubricate the thrust washers, side gear hubs and pinions. (26)—Then install them in the differential case and cover. (27)—Install the high-speed double reduction gear on its pilot on the differential case with the flat side of the gear towards the case. (28)—Then install the cover, making sure to mate the X marks on the case and cover. (29)—Install four bolts evenly spaced and pull them down snug to aid in alignment. (30)—Install the balance of the bolts and pull them down tight. (31)—Lock the nuts with a tiewire.

The three major units are now ready for assembly in the carrier. (32)—Install the shifter yoke and thread the double reduction shaft past the differential bearing supports and through the opening in the housing for the left bearing, at the same time fitting the shifter yoke to the groove in the shifter sleeve. (33)—Install

DIFFERENTIAL CARRIER, REMOVE, OVERHAUL AND REPLACE

the double reduction shaft bearing outer race in the right side of the carrier and tap it in flush with the carrier. (34)—Install a new gasket on each side and then install the same thickness of shims that were removed when disassembling, making sure the cutout in the gasket and shims line up with the lubrication openings in the housing. (35)—Assemble the bearing caps, being careful to line up the lubrication openings in the cap with those in the carrier. (36)—Install three lock washers and nuts on each cap, evenly spaced, and tighten them securely. (37)—Install the shifter yoke shaft bushing over the shaft and tap it into the carrier. (38)—Then install the cork seal in the top of the bushing. (39)—Assemble the shift lock spring and pawl. (40)—Install the Woodruff key in the shaft, shift lever, lock washer and nut. (41)—Tighten the nut securely. (42)—Check the bearing adjustment. Correct adjustment of the double reduction shaft bearings will produce a slight drag when it is turned by hand. (43)—The bearing is adjusted by shims. (44)—Assemble a new pinion cage gasket and the same thickness of shims that were removed. (45)—Be careful to line up the oil holes. (46)—Assemble the pinion cage and pinion assembly to the carrier with the lubrication fitting in the cage to the top right side, being careful to line up the oil holes. (47)—Install three lock washers, and nuts evenly spaced and tighten them securely.

(48)—If the pinion has to be moved away from the ring gear, add shims between the cage and the carrier to check the backlash with a dial indicator. It should be from .010" to .015". (49)—If the backlash is too small, remove the double reduction shaft bearing caps and remove a shim from the left side and add a shim of the same thickness to the right side. (50)—If backlash is greater than .015", remove a shim from the right side and add a shim of the same thickness to the left side. Continue these adjustments until the backlash is correct. (51)—To check the movement of the shifter sleeve, move the shifter lever to the high-speed position and check the clearance between the shifter sleeve and the high-speed pinion. This should be from .015" to .025". (52)—Make a similar check with the shifter lever in the low-speed position. (53)—Adjustments can be made by turning the shifter lever stop pins which are eccentric, with a large pair of pliers. (54)—A groove in the stop pin indicates the low side of the eccentric.

(55)—Lubricate the differential bearings, assemble the outer races, and install the assembly in the carrier. (56)—Then assemble the adjusting nuts and caps, using the cap screws as a guide to line up the adjusting nuts. (57)—Make sure that the cap and adjusting nuts are installed according to the marks. (58)—Tighten the bearing cap bolts just snug. (59)—Check the position of the double reduction gears with the double re-

duction pinions. (60)—Move the differential by the adjusting nuts until the double reduction gears line up with the double reduction pinions. (61)—Adjust the bearings by pulling the adjusting nut up tight, then backing it off one notch. (62)—Tighten the bearing cap bolts and install the adjusting nut locks. (63)—Then lock all bolts with a wire. (64)—Install the differential and carrier assembly in the axle housing, using a new gasket between the housings. (65)—Remove the pipe plug in the pinion cage and with a lubricating gun, fill the space between the pinion bearings with a pint of lubricant.

(66)—To replace the wheel bearings, place the inner race and roller assembly and the outer race in the wheel hub with the thin edge of the outer race downward. (67)—With a suitable wheel bearing replacer, press the bearing in the hub. (68)—Press the race only far enough to install the snap ring in an arbor press. (69)—Install the snap ring in the groove on the inside of the hub. (70)—Use a driver through the cap screw holes in the end of the hub to force the outer race back in positive contact with the snap ring. (71)—To replace the inner bearing, place the outer race on the bearing in the wheel hub with the wide side of the face down. (72)—Use a driver to press the race against its seat. (73)—Install the inner race and roller assembly. (74)—Install the oil seal with a suitable tool and an arbor press. (75)—Lock the seal in place by prick punching at three equally spaced places. (76)—Install the wheel hub and drum assembly, turning the hub to properly line up the bearings. (77)—Install the thrust washer and adjusting nut.

(78)—To adjust the wheel bearings, tighten the adjusting nut and then back it off 45 degrees. (79)—Turn the wheel hub by hand to make sure the hub turns freely. (80)—Install the adjusting nut lock and check the alignment of the tangs with the slots in the nut. Rotate the hub by hand, grasping the hub at the wheel bolts, to see that the bearings are properly seated and that the hub turns freely. (81)—Bend the tang on the lock down into the notch of the adjusting nut. (82)—Install the other lock nut and pull it up tight to prevent any loosening of the adjusting nut. (83)—Bend the tang of the lock into the notch of the lock nut.

(84)—Install a new axle shaft flange gasket on the axle shaft and push the shaft into the housing. (85)—Use a new lock plate at the axle shaft cap screws and insert the cap screws in the axle shaft flange, tightening them alternately and make sure that they are pulled tight. (86)—Then bend the tangs of the lock plate against the heads of the cap screws. (87)—Assemble the rear universal joint. (88)—Replace the axle housing cover and gasket. (89)—Refill the rear axle with the proper lubricant to the level of the filler plug.

AXLE SHAFT REMOVE AND REPLACE

GROUP No. 200

Fig. 178

CHRYSLER 1936-1942. DODGE 1936-1942.
HUPMOBILE 1936-1939.
PACKARD 1938-1942.
STUDEBAKER 1936-1942.
DE SOTO 1936-1942.
GRAHAM 1936 CRUSADER
NASH 1936-1942. PLYMOUTH 1936-1942.
WILLYS 1936-1942.

DISASSEMBLE

(1)—Raise the rear end of the car. (2)—Remove the rear wheel. (3)—Remove the cotter pin, nut and washer from the outer end of the axle shaft. (4)—Remove the hub and brake drum assembly with a suitable puller. Do not use a knock-off type of puller or strike the end of the axle shaft to loosen the hub because damage can be done to the differential parts by this method. (5)—Block the brake pedal to the floor board so that it cannot be depressed. (6)—Disconnect the hydraulic brake line from the wheel cylinder. (7)—Remove the stud nuts which hold the oil seal and brake support to the axle housing and remove the oil seals, brake support and shims. If both axle shafts are to be removed, keep the shims on each shaft separate and assembled to their respective ends of the axle housing to maintain the correct bearing adjustment. (8)—With a suitable puller, remove the axle shaft and bearing assembly. (9)—With a bearing puller, remove the bearing from the axle shaft. (10)—Use an oil seal puller to remove the seals from the housing.

If an axle shaft is broken less than 8" from the inner end of the shaft, the inner piece can be removed when the differential and carrier are removed. If the break is more than 8" from the inner end of the shaft, it will be necessary to snare the inner end out through the housing with a wire loop or a similar tool, after removing the inner oil seal.

ASSEMBLE

(1)—Replace the shaft and bearings in the reverse order. (2)—Use a suitable drift to replace the oil seal. If a new leather oil seal is to be installed, soak the leather in oil for about 30 minutes and work it with a smooth steel bar until it is soft and pliable. If the old parts are replaced and the shims have not been disturbed, the end play should be correct when the parts have been assembled. If a new axle shaft, bearing, differential carrier or housing has been installed, it will be necessary to check the end play.

End play can be checked when all the parts have been replaced except the wheel and hub. (3)—To

make this check, rap each axle shaft, after the bolts are tight, to be sure the bearing cups are seated. (4)—Then place an indicator on the axle shaft and housing to determine the amount of end play of the shaft by pushing in and pulling out the shaft. (5)—If an adjustment is necessary, remove the axle shaft bearing oil seal and the brake support plate, after disconnecting the brake tube as already described. (6)—Add or remove shims to adjust the end play. Shims are located between the rear wheel brake support and the outer side of the axle housing flange. When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain a central position of the axle shaft thrust block. The hole in the thrust block is sufficiently larger than the diameter of the shaft to prevent axle shaft thrust from being thrown on the pinion shaft, providing the thrust block is held in its central position on the shaft.

GROUP No. 201

Fig. 178

HUDSON 1936-1942

DISASSEMBLE

(1)—Raise the rear end of the car. (2)—Remove the rear wheel. (3)—Remove the cotter pin, nut and washer from the outer end of the axle shaft. (4)—Remove the hub and brake drum assembly with a suitable puller. Do not use a knock-off type of puller or strike the end of the axle shaft to loosen the hub because damage can be done to the differential parts by this method. (5)—Block the brake pedal to the floor board so that it cannot be depressed. (6)—Disconnect the hydraulic brake line from the wheel cylinder. (7)—Remove the stud nuts which hold the oil seal and brake support to the axle housing and remove the oil seals, brake support and shims. If both axle shafts are to be removed, keep the shims on each shaft separate and assembled to their respective ends of the axle housing to maintain the correct bearing adjustment. (8)—With a suitable puller, remove the axle shaft and bearing assembly. (9)—With a bearing puller, remove the bearing from the axle shaft. (10)—Use an oil seal puller to remove the seals from the housing.

If an axle shaft is broken less than 8" from the inner end of the shaft, the inner piece can be removed when the differential and carrier are removed. If the break is more than 8" from the inner end of the shaft, it will be necessary to snare the inner end out through the housing with a wire loop or a similar tool, after removing the inner oil seal.

ASSEMBLE

(1)—To renew the axle shaft thrust button, grind off the thrust button flush with the end of the shaft

PASSENGER CAR AXLE SHAFT, REMOVE AND REPLACE

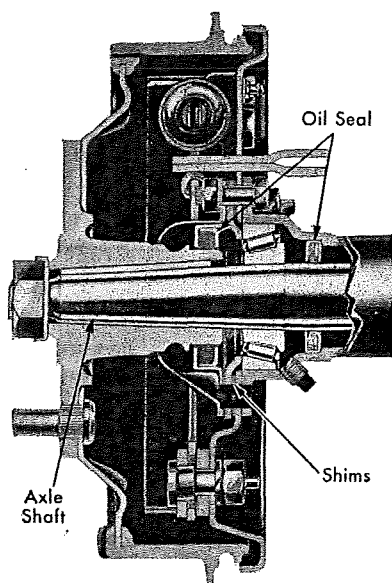


Fig. 178—Group Nos. 200 and 201 Axle Shaft

on an emery wheel. (2)—Center punch the remainder of the thrust button and drill an $\frac{11}{32}$ " hole through the center. (3)—Tap out the button with a $\frac{3}{8}$ "-16 tap and screw a cap screw with the same thread and $1\frac{1}{2}$ " to 2" long into the tapped hole. (4)—Place the head of the screw in a vise and with a soft hammer, tap the end of the axle shaft, removing the button. (5)—Clean out the hole. (6)—Drive in a new thrust button making certain that it is firmly seated in the shaft.

(7)—Replace the shaft and bearings in the reverse order. (8)—Use a suitable drift to replace the oil seal. If a new leather oil seal is to be installed, soak the leather in oil for about 30 minutes and work it with a smooth steel bar until it is soft and pliable. If the old parts are replaced and the shims have not been disturbed, the end play should be correct when the parts have been assembled. If a new axle shaft, bearing, differential carrier or housing has been installed, it will be necessary to check the end play.

End play can be checked when all the parts have been replaced except the wheel and hub. (9)—To make this check, rap each axle shaft, after the bolts are tight, to be sure the bearing cups are seated. (10)—Then place an indicator on the axle shaft and housing to determine the amount of end play of the shaft by pushing in and pulling out the shaft. (11)—If an adjustment is necessary, remove the axle shaft bearing oil seal and the brake support plate, after disconnecting the brake tube as already described. (12)—Add or remove shims to adjust the end play. Shims are located between the rear wheel brake support and the outer side of the axle housing flange. When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain a central position of the axle shaft thrust block. The hole in the thrust block is sufficiently larger than the diameter of the

shaft to prevent axle shaft thrust from being thrown on the pinion shaft, providing the thrust block is held in its central position on the shaft.

GROUP No. 202

Fig. 179

GRAHAM 1936-1941 Except 1936 CRUSADER
OLDSMOBILE 1936. PACKARD 1936-1937.

DISASSEMBLE

(1)—Raise the rear end of the car. (2)—Remove the rear wheel. (3)—Remove the cotter pin, nut and washer from the outer end of the axle shaft. (4)—Remove the hub and brake drum assembly with a suitable puller. Do not use a knock-off type of puller or

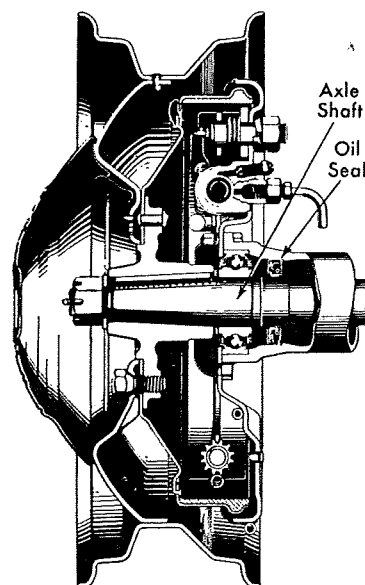


Fig. 179—Group No. 202 Axle Shaft

strike the end of the axle shaft to loosen the hub because damage can be done to the differential parts by this method. (5)—Block the brake pedal to the floor board so that it cannot be depressed. (6)—Disconnect the hydraulic brake line from the wheel cylinder. (7)—Remove the stud nuts which hold the oil seal and brake support to the axle housing and remove the oil seal, and brake support. (8)—With a suitable puller, remove the axle shaft and bearing assembly. (9)—With a bearing puller, remove the bearing from the axle shaft. (10)—Use an oil seal puller to remove the seal from the housing.

(11)—If the axle shaft is broken less than 8" from the inner end of the shaft the inner piece can be removed when the differential and carrier are removed. If the break is more than 8" from the inner end of the

PASSENGER CAR AXLE SHAFT, REMOVE AND REPLACE

shaft it will be necessary to snare the inner end out through the housing with a wire loop or a similar tool, after removing the oil seal.

ASSEMBLE

(1)—Replace the shaft oil seal and bearing in the reverse order from which they were removed. (2)—Use a suitable drift to replace the oil seal. If a new leather oil seal is to be installed, soak the leather in oil for about 30 minutes and work it with a smooth steel bar until it is soft and pliable. As the shaft is mounted on a ball bearing, there is no adjustment for end play except to replace the worn bearing.

GROUP No. 203

Fig. 180

BUICK 40-1936; 40, 60-1937; ALL 1938-42
CHEVROLET 1936-1942. PONTIAC 1936

DISASSEMBLE

(1)—Raise the rear end of the car. (2)—Remove the rear wheel. (3)—Remove the brake drum from the axle shaft flange. (4)—Drain the lubricant and remove the differential cover. (5)—Remove the differential shaft lock screw. (6)—Pull out the differential shaft and the spacer block around it. (7)—Rotate the ring gear and remove the pinions. (8)—Push the axle shaft in toward the differential and remove the C washer from the recess at the inner end of the shaft. (9)—Using a suitable puller, remove the shaft from the housing. (10)—To remove the rear wheel bearing, insert a bearing puller into the housing and pull the bearing and oil seal out as an assembly.

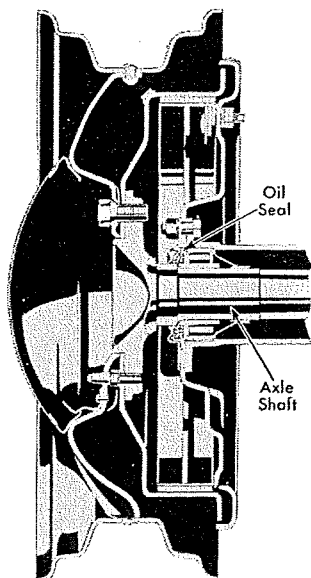


Fig. 180—Group Nos. 203 and 206 Axle Shaft

ASSEMBLE

(1)—Replace the shaft in the reverse order, using a suitable driver to replace the bearings on the shaft. (2)—Check the end play. The maximum total side clearance of the spacer block is .008". Spacer blocks of several sizes are available for service to take up this play. (3)—If the block does not take up the clearance, new thrust washers should be installed in back of the differential side gears. If both axle shafts are removed, and they are not the same length, the longer shaft must be installed on the right side.

GROUP No. 204

Fig. 181

OLDSMOBILE 1937-1942
PONTIAC 1937-1942

DISASSEMBLE

(1)—Raise the rear end of the car. (2)—Remove the rear wheel. (3)—Remove the brake drum from the axle shaft flange. (4)—Drain the lubricant. (5)—With a suitable puller, remove the shaft from the housing. To remove the wheel bearing, insert a bearing puller into the housing and pull the bearing and oil seal out as an assembly.

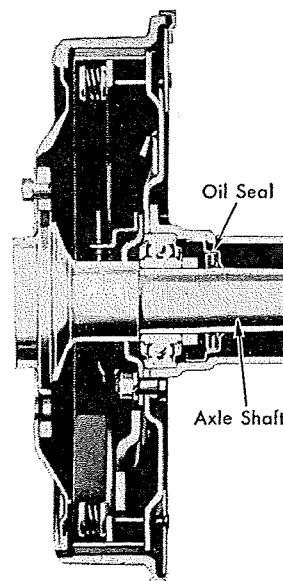


Fig. 181—Group No. 204 Axle Shaft

ASSEMBLE

(1)—Replace the shaft in the reverse order, using a driver to replace the bearing. As the shaft is mounted on a ball bearing, there is no adjustment for end play except to replace the worn bearing.

PASSENGER CAR AXLE SHAFT, REMOVE AND REPLACE

GROUP No. 205

Fig. 182

BUICK 90-1936

DISASSEMBLE

(1)—Raise the rear end of the car. (2)—Remove the rear wheel. (3)—Remove the nut and lock washer from the outer end of the axle shaft and remove the wheel hub. (4)—Drain the lubricant and remove the differential cover. (5)—Remove the differential shaft

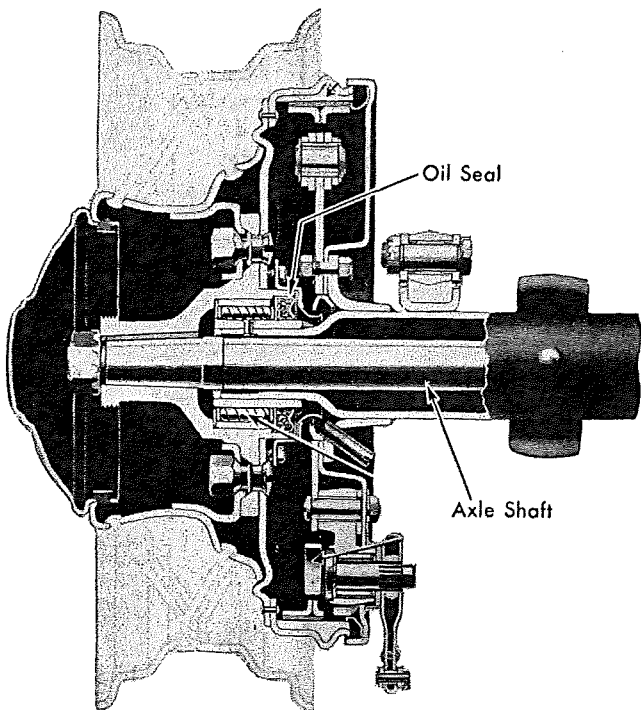


Fig. 182—Group No. 205 Axle Shaft

lock screw. (6)—Pull out the differential shaft and the spacer block around it. (7)—Rotate the ring gear and remove the pinions. (8)—Remove the cotter pin from the inner end of the shaft and remove the lock nut. (9)—Using a suitable puller, remove the shaft from the housing. (10)—The rear wheel bearing can be removed after the wheel and hub are removed.

ASSEMBLE

(1)—Replace the parts in the reverse order. (2)—Check the end play. The maximum total side clearance of the spacer block is .008". The spacer blocks furnished for service are standard production size and .020" oversize. If necessary, the spacer should be sanded to fit. If the block does not take up the excess clearance, new thrust washers should be installed in back of the differential side gears.

GROUP No. 206

Fig. 180

BUICK 60, 80-1936; 80, 90-1937

DISASSEMBLE

(1)—Raise the rear end of the car. (2)—Remove the rear wheel. (3)—Remove the brake drum from the axle shaft flange. (4)—Drain the lubricant and remove the differential cover. (5)—Remove the differential shaft and the spacer block around it. (6)—Rotate the ring gear and remove the pinions. (7)—Remove the cotter pin from the inner end of the shaft and remove the lock nut. (8)—With a suitable puller, remove the shaft from the housing. (9)—To remove the rear wheel bearing, insert a suitable bearing puller in the outer end of the housing and pull the bearing and oil seal out as an assembly.

ASSEMBLE

(1)—Replace the shaft in the reverse order, using a suitable driver to replace the bearing on the shaft. (2)—Check the end play. The maximum total side clearance of the spacer block is .008". The spacer blocks furnished for service are standard production size and .020" oversize. If necessary, the spacer should be sanded to fit. If the block does not take up the clearance, new thrust washers should be installed in back of the differential side gears.

NOTE

Details covering axle shaft, remove and replace, applying to Chevrolet, Dodge and Ford Trucks can be found as follows:

● CHEVROLET TRUCKS

½, ¾ and 1 Ton Truck

See Group No. 111.....Page 139

1½ Ton Truck

See Group No. 118.....Page 151

● DODGE TRUCKS

See Group No. 124.....Page 162

● FORD TRUCKS

(Hotchkiss Drive)

See Group No. 114.....Page 144

● FORD TRUCKS

(Torque Tube Drive)

See Group No. 115.....Page 146

INDEX

AUBURN

	Page
Transmission, Remove and Replace	18
Transmission, Overhaul	
1933-36..All Sixes	Group No. 8.. 45
1935-36..All Eights	Group No. 29.. 80

AUTOCAR TRUCK

Transmission, Overhaul	
Own, DF, UDF	Group No. 64.. 115
Own RL, URL	Group No. 65.. 116
Clark, 185F	Group No. 39.. 93
Clark, 230F, 231F	Group No. 40.. 94
Clark, 200V, 205V	Group No. 38.. 92
Fuller, 5-A-43, 5-A-62	Group No. 46.. 100
Differential Carrier	
Timken, 54412, 56400, 56410..	Group No. 116.. 147

AVAILABLE TRUCK

Transmission, Overhaul	
Brown-Lipe, 2341	Group No. 51.. 104
Fuller, 5-A-290, 5-A-330, 5-A-380,	
5-A-430, 5-A-620	Group No. 46.. 100
Warner, T9, T9A	Group No. 36.. 90
Differential Carrier	
Timken, 53300, 53508, 54411, 54412,	
56410	Group No. 116.. 147

AXLE SHAFT

Remove and Replace	Pages 183-186
--------------------------	---------------

BROCKWAY TRUCK

Transmission, Overhaul	
Brown-Lipe, B-341, 2341	Group No. 51.. 104
Fuller, MHU	Group No. 48.. 101
Fuller, 5-A-38, 5-A-43, 5-A-62..	Group No. 46.. 100
Warner, T9	Group No. 36.. 90
Differential Carrier	
Timken, 53307, 53521, 54300, 54411,	
56410	Group No. 116.. 147

BROWN-LIPE TRANSMISSIONS

Transmission, Overhaul	
Brown-Lipe, 5331	Group No. 55.. 107
Brown-Lipe, 234	Group No. 54.. 106
Brown-Lipe, B-341, 2341	Group No. 51.. 104
Brown-Lipe, 2441	Group No. 52.. 105
Brown-Lipe, 224	Group No. 53.. 106
Brown-Lipe, 3241, 3341, 3440, 5341,	
7341	Group No. 50.. 103
Brown-Lipe, 5351	Group No. 56.. 108
Brown-Lipe, 5352	Group No. 57.. 109
Brown-Lipe, 2252, 2253, 2352, 2353	
Group No. 58.. 110	
Brown-Lipe, 3481	Group No. 59.. 111
Brown-Lipe, 2321, 2323	Group No. 60.. 112
Brown-Lipe, 3221, 3222, 5222..	Group No. 61.. 113

BUICK

Gearshift, Adjust	Page 1
Transmission, Remove and Replace	Page 18

Transmission, Overhaul

	Page
1933-35..1933 All, 34-60, 34-90, 35-60,	
35-90	Group No. 24.. 70
1935-38..Series 40, 50	Group No. 20.. 66
1936-38..Series 60, 80, 90	Group No. 16.. 60
1939-42..Series 40, 50	Group No. 19.. 64
1939-42..Series 60, 70, 80, 90..	Group No. 17.. 61
Differential Carrier	
1936..90	Group No. 110.. 138
1936-42..Except 36-90	Group No. 109.. 136
Axle Shaft, R. & R.	
1936..40	Group No. 203.. 185
1936..60, 80	Group No. 206.. 186
1936..90	Group No. 205.. 186
1937..40, 60	Group No. 203.. 185
1937..80, 90	Group No. 206.. 186
1938-42..All	Group No. 203.. 185

CADILLAC

Gearshift, Adjust	Page 2
Transmission, Remove and Replace	Page 19
Transmission, Overhaul	
1935..All	Group No. 23.. 69
1936..36-60	Group No. 22.. 68
1936-37..1936 Except 36-60,	
37-90	Group No. 23.. 69
1937-42..All Except 37-90	Group No. 18.. 63

CHEVROLET

Gearshift, Adjust	Page 3
Transmission, Remove and Replace	Page 20
Transmission, Overhaul	
1933-36..All Standard Models	
Group No. 12.. 54	
1933-36..All Master Models and ½ Ton	
Trucks	Group No. 13.. 55
1937-39..All Passenger Cars and ½, ¾	
and 1 Ton Trucks	Group No. 14.. 56
1940-42..All Passenger Cars and ½ and	
¾ Ton Trucks	Group No. 15.. 58
Differential Carrier	
1936..All	Group No. 111.. 139
1937-42..All	Group No. 112.. 141
Axle Shaft, R. & R.	
1936-42	Group No. 203.. 185

CHEVROLET TRUCK

Transmission, Overhaul	
1931-42..Truck, All Models Using Four-Speed	
Transmission and Torque Tube Drive	
Group No. 32.. 85	
Differential Carrier	
1936-39..All ½, ¾ and 1 Ton Trucks	
Group No. 111.. 139	
1936-39..1½ Ton Truck with Spiral Bevel Gears	
—Torque Tube Drive	Group No. 119.. 153
1940..1½ Ton Truck with Hypoid Gears—	
Torque Tube Drive	Group No. 119.. 153
1940-42..1½ Ton Truck with Hypoid Gears—	
Hotchkiss Drive	Group No. 118.. 151

INDEX

CHEVROLET TRUCK—Continued		Page
Two-Speed Axle (Timken) ..	Group No. 136..	180
Own, Full-Floating with Hotchkiss Drive	Group No. 118..	151
Own, Full-Floating with Torque Tube	Group No. 119..	153
Eaton, Two-Speed	Group No. 135..	178
Axle Shaft, R. & R.		
1/2, 3/4 and 1 Ton Truck..	See Group No. 111..	139
1 1/2 Ton Truck	See Group No. 118..	151

CHRYSLER

Gearshift, Adjust	Page	8
Transmission, Remove and Replace	Page	21
Transmission, Overhaul		
1935-38..C6, CZ, C7, C8, C14, C16, C18	Group No.	5.. 38
1935-39..C1, C2, C3, C10, C11, C15, C17, C19, C20, C23, C24 With Overdrive	Group No.	4.. 36
1936-37..C7, C8. Transmission and Overdrive in Single Housing ..	Group No.	3.. 36
1939..C22	Group No.	6.. 41
1940-42..All. Three-Speed ..	Group No.	1.. 30
1941-42..Six. Four-Speed ..	Group No.	25.. 71
Differential Carrier		
1936-39..All	Group No. 100..	122
1940..C25, C26	Group No. 100..	122
1940..C27	Group No. 101..	124
1941..C28, C30	Group No. 100..	122
1941..C33	Group No. 101..	124
1942..C34, C36	Group No. 100..	122
1942..C37	Group No. 101..	124
Axle Shaft, R. & R.		
1936-42	Group No. 200..	183

CLARK TRANSMISSIONS

Transmission, Overhaul		
Clark, 140T	Group No.	42.. 96
Clark, 170FS	Group No.	41.. 95
Clark, 185F	Group No.	39.. 93
Clark, 230F, 231F	Group No.	40.. 94
Clark, 200V, 200VO, 205V, 205VO	Group No.	38.. 92
Clark, 270V, 270VO, 326V, 326VO	Group No.	43.. 97

CLARK AXLES

Differential Carrier		
Clark, B-373	Group No.	123.. 160
Clark, R-650, R-750	Group No.	122.. 159
Clark, R-950, R-1100	Group No.	121.. 158
Clark, R-1300	Group No.	120.. 156

CONDOR TRUCK

Transmission, Overhaul		
Clark, 185F	Group No.	39.. 93
Clark, 200V	Group No.	38.. 92
Warner, T9, T9A	Group No.	36.. 90
Differential Carrier		
Timken, 53300, 54411, 56411..	Group No. 116..	147

CORBITT TRUCK

Transmission, Overhaul		Page
Fuller, 5-A-330, 5-A-380, 5-A-430, 5-A-620	Group No.	46.. 100
Warner, T9	Group No.	36.. 90
Differential Carrier		
Timken, 53615, 54400, 54411, 56200, 56410, 56411, 58205, 58300	Group No. 116..	147

DART TRUCK

Transmission, Overhaul		Page
Fuller, MLU	Group No.	48.. 101
Fuller, 5-A-330, 5-A-430, 5-A-620	Group No.	46.. 100
Differential Carrier		
Timken, 53200, 54412, 56411, 58300	Group No. 116..	147

DAY ELDER TRUCK

Transmission, Overhaul		Page
Fuller, MLU	Group No.	48.. 101
Warner, T9	Group No.	36.. 90
Differential Carrier ..		
Timken, 53300, 54410, 56200..	Group No. 116..	147

DE SOTO

Gearshift, Adjust	Page	9
Transmission, Remove and Replace	Page	22
Transmission, Overhaul		
1935..SG With Overdrive...	Group No.	4.. 36
1935-38..SF, S1, S3, S5	Group No.	5.. 38
1936..All. Transmission and Overdrive in Single Housing	Group No.	3.. 36
1939..All	Group No.	6.. 41
1940-42..All. Three-Speed ..	Group No.	1.. 30
1941-42..Four-Speed	Group No.	25.. 71
Differential Carrier		
1936-42..All	Group No. 100..	122
Axle Shaft, R. & R.		
1936-42	Group No. 200..	183

DIAMOND T TRUCK

Transmission, Overhaul		
Brown-Lipe, 2341	Group No.	51.. 104
Clark, 185F	Group No.	39.. 93
Clark, 200V	Group No.	38.. 92
Clark, 270V	Group No.	43.. 97
Warner, T83	Group No.	8.. 45
Warner, T9, T9A	Group No.	36.. 90
Differential Carrier		
Clark, B-373	Group No.	123.. 160
Clark, R-650, R-750	Group No.	122.. 159
Clark, R-950, R-1100	Group No.	121.. 158
Clark, R-1300	Group No.	120.. 156
Eaton, Two-Speed	Group No. 135..	178
Timken, 58300	Group No. 116..	147

DIFFERENTIAL CARRIER

Remove, Overhaul and Replace	Pages 122-182
------------------------------------	---------------

DIVCO TRUCK

Transmission, Overhaul	Page
Warner, T9	Group No. 36.. 90
Differential Carrier	
Timken, Full-Floating	Group No. 116.. 147

DODGE

Gearshift, Adjust	Page 10
Transmission, Remove and Replace	Page 23
Transmission, Overhaul	
1935-38..All	Group No. 5.. 38
1939 ..All	Group No. 6.. 41
1940-42..All	Group No. 1.. 30
Differential Carrier	
1936-42..All	Group No. 100.. 122
Axle Shaft, R. & R.	
1936-42	Group No. 200.. 183

DODGE TRUCK

Transmission, Overhaul	
Own	Group No. 35.. 89
Warner, T86	Group No. 5.. 38
Warner, T9	Group No. 36.. 90
Clark	Group No. 38.. 92
Differential Carrier	
1936, LC	Group No. 100.. 122
1936, LE, LF, LG, LH	Group No. 124.. 162
1937, MC, MD	Group No. 100.. 122
1937, ME, MF, MG, MH	Group No. 124.. 162
1938, RC, RD	Group No. 100.. 122
1938, RE, RF, RG, RH	Group No. 124.. 162
1939, TC, TD	Group No. 100.. 122
1939, TE, TF, TH	Group No. 124.. 162
1940, VC, VD-15	Group No. 100.. 122
1940, VD-20, VD-21	Group No. 101.. 124
1940, VF, VM, VG, VH	Group No. 125.. 164
1941-42, WC, WD-15	Group No. 100.. 122
1941-42, WD-20, WD-21	Group No. 101.. 124
1941-42, WF, WFM, WH, WHM	Group No. 125.. 164
Differential Carrier	
Own, Semi-Floating with Two-Pinion Differential	Group No. 100.. 122
Own, Semi-Floating with Barrel-Type Differential	Group No. 101.. 124
Own, Full-Floating with Two-Bearing Pinion	Group No. 124.. 162
Own, Full-Floating with Three-Bearing Pinion	Group No. 125.. 164
Axle Shaft, R. & R.	
	See Group No. 124.. 162

EATON AXLE

Differential Carrier	
Eaton, Two-Speed	Group No. 135.. 178

FARGO

Transmission, Overhaul	
See Dodge Truck	
Differential Carrier	
See Dodge Truck	

FEDERAL TRUCK

Transmission, Overhaul	Page
Clark, 185F	Group No. 39.. 93
Clark, 200V, 205V	Group No. 38.. 92
Clark, 270V, 326V	Group No. 43.. 97
Warner, T9	Group No. 36.. 90
Differential Carrier	
Clark, B-373	Group No. 123.. 160
Timken, 53300, 53303, 53307, 53308, 53393, 53397, 53503, 53521, 53563, 54411, 56411, 58300, 58301	Group No. 116.. 147

FORD

Gearshift, Adjust	Page 10
Transmission, Remove and Replace	Page 24
Transmission, Overhaul	
1932-42..All	Group No. 9.. 47
Differential Carrier	
1933-42	Group No. 107.. 133

FORD TRUCK

Transmission, Overhaul	
Own	Group No. 9.. 47
Warner, T9	Group No. 36.. 90
Differential Carrier	
1933-42	Group No. 107.. 133
1934-39..Trucks and Buses with Torque Tube Drive	Group No. 115.. 146
1940-42..Trucks and Buses with Hotchkiss Drive	Group No. 114.. 144
Eaton, Two-Speed	Group No. 135.. 178
Axle Shaft, R. & R.	
With Hotchkiss Drive	See Group No. 114.. 144
With Torque-Tube Drive	See Group No. 115.. 146

FULLER TRANSMISSIONS

Transmission, Overhaul	
Fuller, MHU, MKU, MLU, MRU	Group No. 48.. 101
Fuller, 5-A-29, 5-A-290, 5-A-33, 5-A-330, 5-A-38, 5-A-380, 5-A-43, 5-A-430, 5-A-62, 5-A-620	Group No. 46.. 100
Fuller, AR, UR	Group No. 47.. 101
Fuller, AR-163, UR-163	Group No. 47.. 101
Fuller, AY, 3AY	Group No. 49.. 102

GMC TRUCK

Transmission, Overhaul	
1937-42..1/2 Ton Truck using Three-Speed Synchro-Mesh with Remote Control Gear Shift	Group No. 33.. 87
Three-Speed Auxiliary	Group No. 34.. 88
Own, Remote Control Gear Shift	Group No. 33.. 87
Own	Group No. 32.. 85
Clark, 170FS	Group No. 41.. 95
Clark, 200V	Group No. 38.. 92
Own	Group No. 34.. 88

INDEX

GMC TRUCK—Continued

Differential Carrier (with spiral bevel gear)	
1937-38.. T-14;	
1938.. T-15, T-145;	Page
1939-40.. AC-100, AC-150.	Group No. 111.. 139
Differential Carrier (with hypoid gear)	
1940.. AC-100, AF-100, AC-150, AF-150;	
1941.. CC-100, CC-150.	Group No. 112.. 141
Differential Carrier	
Series F-23H, F-33, F-33H, T-33, T-33H;	
AC-550, 600, 650;	
AF-550, 600, 650.	Group No. 117.. 149
Timken, Two-Speed	Group No. 136.. 180
Eaton, Two-Speed	Group No. 135.. 178

GEARSHIFT

Adjust	Pages 1-17
--------------	------------

GRAHAM

Gearshift, Adjust	Page 10
Transmission, Remove and Replace	Page 24
Transmission Overhaul	
1935-40.. 72, 73, 75, 90, 110, 116, 120;	
1938-40.. All	Group No. 29.. 80
1935-37.. 74, 80, 80A, 90A,	
85, 95	Group No. 30.. 82
1936-37.. 1936 All and Early 1937.	
Transmission and Overdrive in	
Single Housing	Group No. 3.. 36
Differential Carrier	
1935-40	Group No. 103.. 127
Axle Shaft, R. & R.	
1936-41.. Except 1936	
Crusader	Group No. 202.. 184
1936.. Crusader	Group No. 200.. 183

GRAMM TRUCK

Transmission, Overhaul	
Clark, 185F	Group No. 39.. 93
Clark, 200V	Group No. 38.. 92
Clark, 270V	Group No. 43.. 97
Warner, T83	Group No. 8.. 45
Warner, T9, T9A	Group No. 36.. 90
Differential Carrier	
Clark, B-373	Group No. 123.. 160
Clark, R-650, R-750	Group No. 122.. 159
Timken, 53300, 54411, 54413,	
56410, 58200	Group No. 116.. 147

HENDRICKSON TRUCK

Transmission, Overhaul	
Brown-Lipe, 5352	Group No. 57.. 109
Fuller, 5-A-33, 5-A-38, 5-A-43,	
5-A-62	Group No. 46.. 100
Differential Carrier	
Clark, R-950, R-1100	Group No. 121.. 158
Timken, 58200	Group No. 116.. 147
Eaton, Two-Speed	Group No. 135.. 178

HENNEY TRUCK

Transmission, Overhaul	
See Packard Transmission, Overhaul	
Differential Carrier	
See Packard Passenger Car Axle	

HUDSON

Gearshift, Adjust	Page 11
Transmission, Remove and Replace	Page 24
Transmission, Overhaul	
1932-40.. All	Group No. 11.. 52
1941-42.. All	Group No. 7.. 43
Differential Carrier	
1936-42	Group No. 102.. 125
Axle Shaft, R. & R.	
1936-42	Group No. 201.. 183

HUG TRUCK

Transmission, Overhaul	
Brown-Lipe, 5341	Group No. 50.. 103
Clark, 185F	Group No. 39.. 93
Fuller, MLU, MRU	Group No. 48.. 101
Fuller, 5-A-33, 5-A-330, 5-A-380, 5-A-43,	
5-A-430, 5-A-62	Group No. 46.. 100
Fuller, AY	Group No. 49.. 102
Differential Carrier	
Clark, B-373	Group No. 123.. 160
Clark, R-950, R-1100	Group No. 121.. 158
Clark, R-1300	Group No. 120.. 156

HUPMOBILE

Transmission, Remove and Replace	Page 24
Transmission, Overhaul	
1935-36.. 521-O, 527-T, 621-O,	
621-N	Group No. 4.. 36
1935-36.. 517-W, 518-D, 521-J,	
618-D, 618-G	Group No. 8.. 45
1938-39.. All	Group No. 29.. 80
Free Wheel	Group No. 8.. 47
Differential Carrier	
1935-40	Group No. 103.. 127
Axle Shaft, R. & R.	
1936-39	Group No. 200.. 183

INDIANA TRUCK

Transmission, Overhaul	
Brown-Lipe, 3341, 5341	Group No. 50.. 103
Brown-Lipe, 224	Group No. 53.. 106
Brown-Lipe, 5352	Group No. 57.. 109
Warner, T9	Group No. 36.. 90
Differential Carrier	
Timken, 53200, 53300, 54300,	
54413, 58205	Group No. 116.. 147

INTERNATIONAL TRUCK

Transmission, Overhaul	
Own	Group No. 45.. 99
Own	Group No. 44.. 98
Warner, T9	Group No. 36.. 90
Fuller	Group No. 48.. 101
Fuller	Group No. 46.. 100

INTERNATIONAL TRUCK—Continued

Differential Carrier	
1933-42..K1, K2, D1, D2, D5,	Page
C1, C5	Group No. 130.. 172
1935-37..Model C-35	Group No. 129.. 170
1936-42..K3, D15, C15;	
HDR-60, R-1100, R-1101...	Group No. 127.. 167
Own, 708	Group No. 128.. 169
Own, 732H	Group No. 129.. 170
Own, R-56-H, R-1000, R-1001.	Group No. 130.. 172
Eaton, Two-Speed	Group No. 135.. 178

KENWORTH TRUCK

Transmission, Overhaul	
Brown-Lipe, 234	Group No. 54.. 106
Brown-Lipe, 3341, 5341, 7341.	Group No. 50.. 103
Fuller, 5-A-33, 5-A-330, 5-A-430,	
5-A-620	Group No. 46.. 100
Differential Carrier	
Timken, 54300, 54411, 56200,	
56410, 58206, 58300	Group No. 116.. 147

LA FAYETTE

Transmission, Remove and Replace	Page 25
Transmission, Overhaul	
1936..3610, 3640, 3710	
Nash, 3720	Group No. 3.. 36
Differential Carrier	
1934-35..Spicer	Group No. 103.. 127
1936..3610;	
1937..3710;	
1938..3810;	
1939..3910;	
} Nash AxleGroup No. 106.. 131	

LA FRANCE-REPUBLIC TRUCK

Transmission, Overhaul	
Fuller	Group No. 48.. 101
Fuller, 5-A-33, 5-A-430,	
5-A-620	Group No. 46.. 100
Warner, T9	Group No. 36.. 90
Differential Carrier	
Timken, 53300, 53307, 54410, 54411,	
56200, 56410, 56411	Group No. 116.. 147

LA SALLE

Gearshift, Adjust	Page 2
Transmission, Remove and Replace	Page 19
Transmission, Overhaul	
1935-36..All	Group No. 22.. 68
1937-40..All	Group No. 18.. 63

LINCOLN

Transmission, Remove and Replace	Page 25
Transmission, Overhaul	
1933-40..All	Group No. 10 51

LINCOLN-ZEPHYR

Gearshift, Adjust	Page 11
Transmission, Remove and Replace	Page 25

Transmission, Overhaul	
1941-42	Group No. 9.. 49
Differential Carrier	
1936-37	Group No. 107.. 133

MACK TRUCK

Transmission, Overhaul	
Own, TR-30, TR-31	Group No. 69.. 119
Fuller, 5-A-33	Group No. 46.. 100
Warner, TR-11, TR-27	Group No. 36.. 90
Differential Carrier	
Own, RA-17, RA-22, RA-36,	
RA-45	Group No. 126.. 166
Clark, Full-Floating	Group No. 122.. 159
Timken, Full-Floating	Group No. 116.. 147

MACK JR. TRUCK

Transmission, Overhaul	
Warner, T86	Group No. 5.. 38
Warner, T84	Group No. 30.. 82
Warner, TR-11, TR-27	Group No. 36.. 90

MERCURY

Gearshift, Adjust	Page 11
Transmission, Remove and Replace	Page 25
Transmission, Overhaul	
1939-42..All	Group No. 9.. 47
Differential Carrier	
1939-42	Group No. 107.. 133

MORELAND TRUCK

Transmission, Overhaul	
Brown-Lipe, 2341	Group No. 51.. 104
Brown-Lipe, 2441	Group No. 52.. 105
Brown-Lipe, 224	Group No. 53.. 106
Fuller, 5-A-430	Group No. 46.. 100
Warner, T9	Group No. 36.. 90
Differential Carrier	
Timken, 53413, 54411, 56400,	
56411	Group No. 116.. 147

NASH

Gearshift, Adjust	Page 11
Transmission, Remove and Replace	Page 25
Transmission, Overhaul	
1935-38..“Nash” type, Partial.	Group No. 28.. 78
1936 ..“400” Partial	Group No. 29.. 80
1936-37..3640, 3720.	
Transmission and Overdrive in Single	
Housing	Group No. 3.. 36
1939-42..1939-40 All; 1941-42	
Series 60, 80	Group No. 31.. 83
1941-42..Series 40	Group No. 2.. 33

Differential Carrier	
1936..3620, 3680	Group No. 100.. 122
1937..3720	Group No. 106.. 131
1937..3780	Group No. 100.. 122
1938..3820	Group No. 106.. 131
1938..3880	Group No. 100.. 122

INDEX

NASH—Continued	
1939..3980 (Spiral Bevel)	Group No. 100.. 122
1939..3920, 3980 (Hypoid)	Group No. 106.. 131
1940..4020, 4080 (Hypoid)	Group No. 106.. 131
1940..4080 (Spiral Bevel)	Group No. 100.. 122
1941..4140	Group No. 104.. 128
1941..4160, 4180	Group No. 106.. 131
1942..4240	Group No. 104.. 128
1942..4260, 4280	Group No. 106.. 131
Axle Shaft, R. & R.	
1936-42	Group No. 200.. 183

NELSON-LE MOON TRUCK

Transmission, Overhaul	
Brown-Lipe, 234	Group No. 54.. 106
Brown-Lipe, 3341	Group No. 50.. 103
Brown-Lipe, 2341	Group No. 51.. 104
Clark, 185F	Group No. 39.. 93
Clark, 200V	Group No. 38.. 92
Clark, 270V	Group No. 43.. 97
Warner, T9	Group No. 36.. 90
Differential Carrier	
Timken, 53300, 54410, 56200..	Group No. 116.. 147

OLDSMOBILE

Gearshift, Adjust	Page 12
Transmission, Remove and Replace	Page 25
Transmission, Overhaul	
1935-38..All	Group No. 20.. 66
1939-42..All Synchro-Mesh..	Group No. 19.. 64
Differential Carrier	
1936	Group No. 113.. 143
1937-42	Group No. 108.. 134
Axle Shaft, R. & R.	
1936	Group No. 202.. 184
1937-42	Group No. 204.. 185

PACKARD

Gearshift, Adjust	Page 13
Transmission, Remove and Replace	Page 26
Transmission, Overhaul	
1935-38..All Sixes and 120's..	Group No. 26.. 75
1939-42..All Except Twelves..	Group No. 27.. 76
Differential Carrier	
1936-1942..Six and 120 All..	Group No. 105.. 130
Axle Shaft, R. & R.	
1936-37..Six and 120 All . . .	Group No. 202.. 184
1938-42..Six and 120 All . . .	Group No. 200.. 183

PAK-AGE-CAR

Transmission, Overhaul	
Own, Stutz	Group No. 70.. 120
Own, Diamond T	Group No. 71.. 121
Differential Carrier	
Own	Group No. 134.. 178

PIERCE ARROW

Transmission, Remove and Replace	Page 26
Transmission, Overhaul	
1935-38 All	Group No. 8.. 45

PLYMOUTH

Gearshift, Adjust	Page 13
Transmission, Remove and Replace	Page 26
Transmission, Overhaul	
1935-39..1935-38 All and P7, 1939	
	Group No. 5.. 38
1939..P8	Group No. 6.. 41
1940-42..All	Group No. 1.. 30
Differential Carrier	
1936-42..All	Group No. 100.. 122
Axle Shaft, R. & R.	
1936-42	Group No. 200.. 183

PLYMOUTH TRUCK

Transmission, Overhaul	
Own	Group No. 35.. 89
Warner, T9	Group No. 36.. 90
Warner, T86	Group No. 5.. 38

PONTIAC

Gearshift, Adjust	Page 15
Transmission, Remove and Replace	Page 27
Transmission, Overhaul	
1933-35	Group No. 13.. 55
1935-38..Late 1935 and All 1936-38	
	Group No. 20.. 66
1939-42..All	Group No. 19.. 64
Differential Carrier	
1936	Group No. 111.. 139
1937-42	Group No. 108.. 134
Axle Shaft, R. & R.	
1936	Group No. 203.. 185
1937-42	Group No. 204.. 185

REO

Transmission, Remove and Replace	Page 28
Transmission, Overhaul	
1936	Group No. 29.. 80

REO TRUCK

Transmission, Overhaul	
Own	Group No. 62-63.. Pages 113-114
Brown-Lipe, 2341	Group No. 51.. 104
Clark, 231F	Group No. 40.. 94
Clark, 200V, 205V	Group No. 38.. 92
Warner, T86	Group No. 5.. 38
Warner, T83	Group No. 8.. 45
Warner, T84	Group No. 30.. 82
Differential Carrier	
Timken, 53308, 54412, 56411..	Group No. 116.. 147
Clark, Full-Floating with Four-Pinion	
Differential	Group No. 120.. 156
Clark, Full-Floating with Two-Pinion	
Differential	Group No. 123.. 160

REPUBLIC TRUCK

Differential Carrier	
See La France	

SPICER TRANSMISSIONS

See Brown-Lipe

STERLING TRUCK

Transmission, Overhaul	
Brown-Lipe, 5341	Group No. 50.. 103
Brown-Lipe, 5351	Group No. 56.. 108
Fuller, 5-A-29, 5-A-33, 5-A-430, 5-A-62	Group No. 46.. 100
Warner, T9	Group No. 36.. 90
Differential Carrier	
Timken, 53307, 54411, 56410, 56411, 58300	Group No. 116.. 147

STEWART TRUCK

Transmission, Overhaul	
Warner, T9	Group No. 36.. 90
Fuller	Group No. 46.. 100
Differential Carrier	
Clark, Full-Floating with Two-Pinion Differential	Group No. 123.. 160
Eaton, Two-Speed	Group No. 135.. 178

STUDEBAKER

Gearshift, Adjust	Page 17
Transmission, Remove and Replace	Page 28
Transmission, Overhaul	
1933-35..All	Group No. 8.. 45
1936..President	Group No. 4.. 36
1936-37..1936 Dictator and Early 1937 Dictator. Transmission and Overdrive in Single Housing	Group No. 3.. 36
1936-39..1936-38 All and 1939 Com- mander with Floor Shift, But No Over- drive	Group No. 29.. 80
1939-42..All Except 1939 Commander with Floor Shift, But No Overdrive Group No. 2.. 33	
Differential Carrier	
1936-42	Group No. 103.. 127
Axle Shaft, R. & R. 1936-42	Group No. 200.. 183

STUDEBAKER TRUCK

Transmission, Overhaul	
Clark, 140T	Group No. 42.. 96
Clark, 200V	Group No. 38.. 92
Clark, 270V	Group No. 43.. 97
Warner, T88	Group No. 5.. 38
Warner, T9	Group No. 36.. 90
Differential Carrier	
Timken, 54410, 54414, 56410, 56411, 58200, 58300	Group No. 116.. 147

TERRAPLANE

Transmission, Remove and Replace	Page 24
Transmission, Overhaul	
1932-38..All	Group No. 11.. 52

TRANSMISSION.

Remove and Replace	
Passenger Cars	Pages 18-29
Overhaul	
Passenger Cars	Pages 30-85
Trucks	Pages 85-121

TIMKEN AXLES

Differential Carrier	
Timken, All Series 53000, 54000, 56000 58000	Group No. 116.. 147
Chevrolet Two-Speed Axle ..	Group No. 136.. 180

WARNER TRANSMISSIONS

Transmission, Overhaul	
Warner, T83	Group No. 8.. 45
Warner, T84	Group No. 30.. 82
Warner, T86, T88	Group No. 5.. 33
Warner, T9, T9A, TR11, TR27 Group No. 36.. 90	
Warner, T93	Group No. 37.. 91

WHITE TRUCK

Transmission, Overhaul	
Own, 60B	Group No. 66.. 117
Own, 4B, 26B	Group No. 67.. 117
Warner, T9	Group No. 36.. 90
Clark, 170FS	Group No. 41.. 95
Clark, 200V, 205V	Group No. 38.. 92
Differential Carrier	
Own, RA-25C	Group No. 131.. 173
Own, RA-20C	Group No. 132.. 175
Timken, Full-Floating with Four-Pinion Differential	Group No. 116.. 147

WHITE HORSE

Transmission, Overhaul	
Own, 64BA	Group No. 68.. 118
Differential Carrier	
Own,	Group No. 133.. 176

WILLYS

Gearshift, Adjust	Page 17
Transmission, Remove and Replace	Page 29
Transmission, Overhaul	
1933-36..All	Group No. 21.. 68
1937-40..1937-39 All and 1940 Speedway Group No. 30.. 82	
1940-42..1940 DeLuxe, 1941-42 All Group No. 2.. 33	
Differential Carrier	
1936-40	Group No. 104.. 128
Axle Shaft, R. & R. 1936-42..All	Group No. 200.. 183

WILLYS TRUCK

Transmission, Overhaul	
Warner, T84	Group No. 30.. 82

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